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ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

[OFFICIAL CIRCULAR.]

American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION,
Sept. 10th, 1885.

The Thirteenth Annual Meeting of the American Gas Light Association will be held at Cincinnati, Ohio, Wednesday, Thursday, and Friday, October 21st, 22d, and 23d. The headquarters of the Association will be at the Gibson House, and the meetings will be held at College Hall.

The members will find the hotel and hall arrangements very desirable; the hall is close by the hotel, and is a most excellent room for public meetings. The hotel has recently been remodeled, and will be found very convenient.

I am happy to be able to state that present indications would portend that our Thirteenth Annual Convention will be an enjoyable one. Certainly, those who attended our Fifth Annual Meeting, at Cincinnati in 1877, will be very ready to grant that the selection of that city for our coming convention was a happy augury of its success.

Though the literary portion of our programme is not yet completed, nevertheless the number of papers promised, and the partial pledges we have of others, afford good ground for hoping that the time which will be allotted to the consideration of matters of technical interest will be well utilized. We are promised papers on the following subjects:

"Improved Furnaces;" "The Result of a Month's Working with Limed Coal;" "Automatic Street Main Governors;" "Natural Gas;" "A New Photometer;" "The Present State of the Gas Business;" "Difficulties Encountered in the Construction of a Gasholder Tank."

In addition to the above we have four other papers partially promised, and I hope at an early day to add their titles to the above list.

If the members would keep these subjects before them, and collect from time to time such facts and figures in relation thereto as may be in their possession, and be prepared to lay them before the convention during the discussions of these themes, it would add greatly to the interest and value of our proceedings.

Besides the matters which will be brought before the Association by the gentlemen who will read the papers, there are many interesting subjects which could be discussed. At recent meetings of other Associations the question box has been rendered a very important feature of the convention. Yet it is doubtful if this branch of the meeting has been as edifying as it might have been; for many questions are asked which can only be properly answered by the production of some facts or figures, and as the party making the answer has no previous notice of the question it follows that the answer must be made from memory, instead of from the record; and, therefore, the conundrum is but partially answered. Now this could be rectified if we could know in advance the questions to be propounded. If, for instance, a member who wishes a subject discussed, or seeks light on some disputed point, would send in his question at once to the Secretary, he could incorporate it in his next circular, then as the members would have an opportunity to look up definite data on the subject the chances are the party putting the question, as well as the other listeners, would be edified. I would urge this matter on the earnest consideration of the members, and I sincerely hope there will be no hesitancy on the part of all in sending in their questions at as early a day as possible to the Secretary. There need be no holding back in this matter, as the names of the propounders of the queries will not appear

in any way. It will suffice if a member writes out his question and forwards it to me, I will then send to each member a list of the questions to be discussed.

It is hoped each member will make a decided effort to be present at the meeting, that we may have a large and pleasant gathering.

Parties wishing to join the Association can obtain blanks by applying to the Secretary,

C. J. R. Humphreys,
Box 6, Lawrence, Mass.

THE SEMI-ANNUAL MEETING OF THE NEW ENGLAND ASSOCIATION.

The Semi-Annual Meeting of the New England Association of Gas Engineers was held at Point of Pines, near Boston, Mass., on August 25th and 26th, 1885, and an exceedingly pleasant time was had by all who were present. On the first day (Tuesday, the 25th) a formal business meeting was held in the morning, at which an interesting discussion was had upon various matters connected with the gas industry. During the afternoon the members, and their invited guests, devoted themselves to "having a good time;" and in this effort, in spite of the rainy, disagreeable weather, they succeeded admirably.

The next day, fortunately, came off bright and clear, and the members, accompanied by their guests, among whom were many ladies, took a steamer and sailed along the north shore of Massachusetts Bay, returning to the Point of Pines for a banquet at half past two o'clock. The party broke up at 5 P.M., and as the members and their friends took the trains which carried them to their respective homes, all agreed that the "Semi-Annual" of 1885 had been a most enjoyable gathering.

THEY "PUNCHED" OUT THE REGULATORS.

As an average "specimen card" of how fairly the ruling authorities of our cities and towns are disposed toward the managers of local gas undertakings, in the "treatment and adjustment" of certain matters that necessitate mutual relations between both sets of parties, we are enabled to present the following particulars of a transaction that recently happened in the thriving, bustling place known to history, and designated on the maps, as Morristown, N. J.

Of course Morristown's streets must be illuminated at night; and in order that such desirable end be attained a mixed system is resorted to—that is, a certain number of gas lamps are maintained, and the balance of the lighting is eked out by the employment of another certain number of oil lamps, which, noting the latter part of the arrangement, is not always as satisfactory to the residents of the town as it might be. But since it is our intention here to deal exclusively with the doings of the local Solons in regard to the gaseous mode of illumination, we will take leave of the "oily" part of the subject with the parting remark that, all things considered, it might be well for the Morristown dwellers did they give such encouragement to the proprietors of the gas company that the latter would be enabled to extend its mains to such lengths as would ensure the entire lighting of the city's streets by gas.

When the last annual contract was entered into between the Town Council and the gas company it was stipulated therein that the latter would be required to furnish nothing else but gas to the lamp burners, the city agreeing to light, extinguish, clean, and maintain. The rate of consumption was fixed at four feet per hour, and the Gleason "Young America" pattern of burner, regulated to emit the stipulated flow, was installed in the lanterns. The authorities awarded the contract for lighting, etc., to a local firm of gasfitters, and these astute gentlemen employed the necessary help to carry on the work with the following results. The Morristown "helper" must be rather averse to unnecessary work, since shortly after the new burners had been placed in action the Morristown gas folks found that their send-out was increasing in rather too rapid a manner when comparison with their monthly accounts and cash receipts was resorted to for the purpose of seeking a reasonable solution of their seemingly great advance in prosperity. Superintendent Hunt was appealed to, and he informed the management that, for a night or two previous, he had been rather suspicious as to the street lighting consumption; and that he proposed "instituting an investigation." The investigation shortly developed a surprising state of affairs. The helpers, in order to save themselves a little extra trouble in cleaning, etc., had removed the "Young Americas" and "punched" out their (not the helpers' but the burners') regulators. The Councilmen were informed of what had been done by their contractors' employees; but instead of punishing the delinquents some of them were actually inclined to restrain the gas company from replacing the "punched" burners with sound ones, on the score that "the lamps gave a much better light than was the case before the 'punching' occurred." They did not, however, propose to give the gas company any larger sum of money for the increased illumination, and insisted that under the terms of the contract they (the Council) had "full charge of everything except the gas." This seems rather incredible, but the facts are as stated; and it actually took several interviews between representatives of the company and Council before the matter was straightened out. Indeed, it would have absorbed a greater length of time had not the Mayor condescended to acknowledge that "the gas folks were in the right of it." The Morristown lanterns are now equipped with "empire bulbs," and the gas company has been assigned "exclusive control" of the jets—the city still continuing to "light, extinguish, clean, and maintain." Take it all in all, we think the Morristown gas company had better keep an eye on them yet.

RESIGNED HIS POSITION.

We have received notification that Mr. Wm. W. Silkworth, for many years Secretary of the Long Branch (N. J.) Gas Light Company, handed in his resignation to the management of that corporation some short while since, and that his official connection with the company ceased on date of Tuesday, September 8th. His successor in office is Mr. John Torry, who is also connected with the Long Branch water supply company.

While not at present conversant with the circumstances that led to this action on the part of Mr. Silkworth, we are thoroughly convinced that the Long Branch Gas Light Company has lost, by his action in resigning, the services of a capable, efficient, trustworthy and energetic business man. This is said without any inclination to put forward the least slight upon the capacity of his successor; but rather to show an appreciation of the merits of a man whom we have known intimately, both in business and friendly relations, during the past eighteen years. When Mr. Silkworth was named as Secretary to replace Mr. W. E. Fort, some seven or eight years ago, the affairs of the Long Branch company were in a somewhat mixed condition; but the new appointee's tact and zeal speedily convinced the directors that they had found the right man and put him in the right place. Mr. Silkworth's action will undoubtedly be regretted, if not by the management of the company, at least by the residents of New Jersey's famous and beautiful watering place.

OBITUARY NOTE—HON. FRANCIS THOMPSON.

We regret to announce the sudden death of the Hon. Francis Thompson, a resident of Charlestown, Mass., whose demise occurred on the evening of Sunday, Aug. 30th. Mr. Thompson was always a prominent figure in the business and social circles of Charlestown—deceased was born in that city about sixty years ago—and was held in high esteem by the citizens of his birthplace. He was chosen a director in the Charlestown Gas Company, on January 16th, 1871, and on Sept. 12th, 1883, was made President of that corporation. He served his city faithfully and well in various positions of public trust; and, in 1870, was honored by an election to the State Senate, when the city of Charlestown was constituted a separate senatorial district. He was a man of probity and honor. The funeral ceremonies took place on afternoon of September 2d.

Annual Election Vincennes (Ind.) Gas Light Company.

The Citizens Gas Light Company's stockholders held their annual meeting on Tuesday, Sept. 8th. The election resulted in the choice of the same gentlemen who controlled the company's affairs during the past twelvemonth. Annexed is the list: President, Mr. John H. Rabb; Secy., Treas., and Supt., Mr. Geo. G. Ramsdell; Directors, Messrs. Jno. H. Rabb, Geo. G. Reily, W. H. DeWolf, J. L. Bayard, Edward Watson, S. N. Chambers, and Geo. G. Ramsdell.

Friend Ramsdell cannot have much leisure time upon his hands, even despite the fact, as chronicled in our last issue, that he has become quite an adept in the arts and practices of the "esthetic decorator."

The Market for Gas Securities.

The city gas share market has been taken out of the realms of summer dullness; but it must be noted the "quiet" period that prevailed in '85 was remarkable for its lasting power. Consolidated gas, during the last fortnight, sold down as low as 91¼, but the reaction from bottom figures was speedy. At time of writing (3 P.M., Sept. 14) 93¼ was bid, and offerings were made at 93½. On same date one or two transactions were recorded at 94. We continue the advice to investors that Consolidated is a purchase. There is every indication that there will be a brisk and fluctuating market in the near future, and those not seeking to make a speculative turn need not spend their time in "watching the tape," for the shares are worth par and over. Equitable stock options or "rights" are selling at 20 per cent. Mutual is slightly weaker. Brooklyn shares are strong. We note that the Peoples Company, of that city, pay a quarterly dividend of 1½ per cent. on Sept. 15th. Baltimore Consolidated is lower. Nothing else of note.

Gaseous Fuel.

By H. Townsend, Assoc. M. Inst. C.E., of Dewsbury.

[A paper read at the Twenty-second Annual General meeting of the Gas Institute, with discussion on same, and reprinted from *Journal of Gas Lighting.*]

When I was asked a few weeks ago, by our esteemed President, to contribute a paper to this meeting on the subject of "Gaseous Fuel," the time was so short that my first impulse was to courteously decline the request. But when I came to remember that I had also received an indirect invitation of a similar nature from the *Journal of Gas Lighting*, in the first number for the current year, I thought it would be exceedingly ungracious on my part not to respond to this double invitation; and so decided that it was my duty to endeavor, however imperfectly, to meet the wishes of our President, and to prepare a paper, relying upon the generosity and forbearance which I felt sure would be extended to its manifest imperfections by the members of the Institute.

It will doubtless be still fresh in your recollection that, in a series of letters, dated from the town of Bradford (with which I was then connected), which appeared in the *Journal of Gas Lighting* about this time last year, I suggested, as a means of affording the public a supply of cheap gaseous fuel, the conversion into water gas, at the works of our large manufacturing towns, of the coke made in the production at those works of ordinary coal gas. This coke is in some instances very difficult to dispose of, and has consequently to be sent in large quantities to the London and other markets, where it enters into competition with, and depreciates the value of, the coke produced at the local gas works. This gas, I endeavored to prove, could be supplied to the consumer through a separate system of mains, if an adequate market were created for it, at 6d. per 1,000 cubic feet, and would at this price be about equal in calorific value to coal gas at 1s. per 1,000 cubic feet. I also entered pretty fully into the financial aspect of the question, and tried to show that if a market could be found for all the gas which could be so produced, its manufacture would be a very profitable investment for the gas undertakings themselves; and in a letter published in the *Journal*, on May 13, 1884, I stated that I had seen in successful practical operation, on a large scale, the manufacture of water gas from coke, and that I was perfectly satisfied that there was no difficulty either in its manufacture or distribution. I should have been very pleased to have given the meeting a description of the apparatus here referred to, but am not at liberty to do so, as some of the patents are still incomplete; but I may say that the plant which I had the privilege of seeing in action was at a large iron works in Germany. It consisted of the generating apparatus, and a small rectangular box, something like a purifier, to arrest the ash (this being the only impurity there was to remove), and a small telescopic gasholder, capable of containing about 10,000 cubic feet of gas; together with the necessary connections, etc. There was no condenser, the gases getting sufficiently cooled by passing through the pipes to the gasholder. The gasholder was carefully graduated from top to bottom, to enable the production and consumption of gas to be easily ascertained. A "Standard" washer had also been put up to extract the ammonia; but experience proved that no ammonia was formed which paid the cost of extraction, and therefore when I saw the washer it was out of action. In an extremely valuable paper read before the "Institution of Civil Engineers," last year, Dr. Foster showed that it was possible to produce a very considerable amount of ammonia from the nitrogen contained in ordinary coke. Whether it will be commercially possible to recover this ammonia as a bye-product in the manufacture of water gas is a problem which I must leave in the hands of Dr. Foster and other gentlemen who are working in this direction.

The material used consisted of the cinders which had dropped from puddling furnaces on the works. These were washed and screened, and as many of the clinkers as possible picked out. I was told that this fuel generally contained about 20 per cent. of water; and I should say, from my own observation, at least 5 per cent. of clinker. So that it is evident that if good gas could be made from such fuel as this, our own coke would be an admirable material for the purpose. An ordinary laboring man, clad in that esthetic Continental garb, the time-honored blue blonse, was the only attendant; and he seemed to have no difficulty in working the apparatus. It was plain, therefore, that the manufacture of water gas from coke does not require very much skill. From observations which I took on the spot I found that the plant was making gas at the rate of 227 cubic meters, or 8,017 cubic feet per hour; while it was being used in the works at the rate of 3½ cubic meters, or 123 feet per minute. Consequently the production and consumption were pretty evenly balanced. As affording an indication of the scientific manner in which work is carried on in Germany, I may state that at this iron works two chemists were regularly employed; and one of them tested, in my presence, in a laboratory adjoining the gas-making plant, the gas which was being made, and informed me it contained 3 per cent. of carbonic acid.

With the very inferior material in use, I was informed that the average production was 35,000 cubic feet of gas per ton; but with ordinary gas works coke, no doubt was entertained that 50,000 feet per ton (which is the recognized production) would be obtained. Plant to make 20,000 cubic feet of gas per hour, constructed as I saw it, could be erected for about £2,000, exclusive of the holder, and it would occupy a space about 40 feet long by 20 feet wide. In reply to an inquiry I was told that this particular apparatus had been in daily operation for 18 months, and had not so far cost anything for repairs; but that it was intended to renew some of the firebrick lining in a short time. The item of wear and tear was, therefore, not a very large one. This water gas plant could very well have been placed in the vault of a stage retort-house, if it were built a little larger than at present; so perhaps the gas works of the future—if water gas finds favor for industrial purposes—may contain retort houses capable of making simultaneously coal gas for lighting and water gas for heating purposes. I will not here go into the financial aspect of the question further than to state that the result of my observation was to confirm the figures as to the probable cost of water gas made from coke, if supplied by existing gas undertakings, which I placed before the readers of the *Journal of Gas Lighting* last year.

As an illustration of the advantages of gas for industrial purposes, I was informed that, in the special application for which this gas was being used, six times more work was being done in a day by a certain number of men as could possibly be performed by the same number of men using raw coal on the old system; and, in addition to this enormous saving, the work was much better done. Altogether, this firm was so well satisfied with water gas that additional plant, to make double the quantity, was in course of construction when I was there. They also told me that, as the result of experiments, they found that they could obtain much higher and sharper heats with water gas than they could with ordinary coal gas, as the latter required more oxygen for its complete combustion, and a greater proportion of air had, therefore, to be used, and a larger amount of the inert nitrogen to be heated up. Being rather sceptical on this point (as it seemed at variance with orthodox opinions), I have calculated the theoretical initial temperatures produced by the combustion of water gas and coal gas respectively, with the following result: Taking water gas first, and supposing the composition to be 50 per cent. of hydrogen, and 50 per cent. of carbonic oxide, we have in 100 cubic feet 0.2789 lb. of hydrogen, and 3.9048 lbs. of carbonic oxide, which on combustion would yield 34,900 units of heat; and, supposing no excess of air was admitted, would require 4.4624 lbs. of oxygen. The products would be 6.136 lbs. of carbonic acid, 14.949 lbs. of nitrogen, and 2.57 lbs. of steam; and therefore the initial temperature would be—

$$\frac{34{,}900 - (2.57 \times 966.6)}{(6.136 \times 0.2164) + (2.57 \times 0.475) + (14.949 \times 0.244)}$$

or, approximately, 5400° Fahr. Whilst for coal gas, with a composition of (say) 50 per cent. of hydrogen, 40 per cent. of marsh gas, 5 per cent. of ethylene, and 5 per cent. of carbonic oxide, we should have 0.2835 lb. of hydrogen, 1.6872 lbs. of marsh gas, and 0.36,915 lb. each of ethylene and carbonic oxide, which on combustion would yield 69,490 units of heat; and, supposing no excess of air admitted, would require 10.9331 lbs. of oxygen. The products would be 7.086 lbs. of steam, 6.747 lbs. of carbonic acid, and 36.626 lbs. of nitrogen from the 100 cubic feet, and a resultant temperature of—

$$\frac{69{,}490 - (7.086 \times 966.6)}{(7.086 \times 0.475) + (6.747 \times 0.2164) + (36.626 \times 0.244)}$$

or nearly 4600° Fahr.

Thus, although we have just twice the amount of heat from the 100 cubic feet of coal gas that we get from the same amount of water gas, yet it is spread over a much larger quantity of waste gases; and hence the lower initial temperature. Or, to put it in other words, we should get *twice the volume of heat* with 100 cubic feet of coal gas that could be obtained with 100 cubic feet of water gas; but, owing to the greater proportion of air needed for the complete combustion of coal gas as compared with water gas, the latter would give the higher initial temperature.

As many of us are rather frightened at water gas, owing to the reputed poisonous properties of one of its chief constituents—carbonic oxide—I made very careful inquiries on this point, and was informed that, although such large quantities of it were used at these works, no trouble had ever been experienced with it on this score. I was told that the men had often inhaled considerable quantities of it, and it generally made their heads ache when they did so; but when they got into the open air they were soon all right again.

Since writing the foregoing I have had my attention drawn to an article in the *Journal of Gas Lighting*, for the 5th of May, entitled, "The Poisonous Qualities of Water Gas," founded on an investigation into the subject by two American chemists, who have been conducting a series of experiments with water gas. They succeeded in proving that an atmosphere containing certain proportions of carbonic oxide is not conducive to longevity, in the case of certain inoffensive cats, dogs and rabbits which had the honor of

being selected to contribute this information to the world. On turning, however, to the *Journal*, for May 13th, 1884 (p. 819), I find another article, on another report by other American chemists, who summed up their opinion in these words: "Water gas is not more detrimental to health than other illuminating gases." So much for the experiments of American chemists. Experts have the unfortunate tendency of proving just what they are called in to prove; and, as a rule, any desired opinion upon any desired subject may be obtained by those interested.

The simple fact that water gas, carburetted with petroleum, has been in use in the United States for years for lighting purposes, and that it is now the chief lighting agent in no less than 50 towns in that country, proves that it is "not so black as it is painted." The only fatal accidents which have occurred with water gas in the United States have happened in sleeping apartments. I myself should certainly be strongly opposed to the adoption of water gas in this country for illuminating purposes, as people will insist on leaving gas escaping in their bedrooms all night; and then, again, the majority of the gas fittings in private houses are in a very bad state of repair. But for industrial purposes I certainly fail to see any danger in it; as when people are at work they are generally pretty wide-awake to every contingency. Besides, as the fittings would be new and substantial, escapes of gas would be very exceptional. The inhalation of water gas causes a severe headache; and no one, I think, would be likely to inhale sufficient to do him any real harm, especially as the effect passes off as soon as the pure air is breathed again. Such is the conclusion come to by the State of Massachusetts, which employed the chemists whose report, alluded to above, has created such a flutter in the pages of the *Journal*, the decision being that coal gas only shall be used for lighting, but that water gas may be supplied for fuel purposes.

Shortly after my return from Germany, pressure was brought to bear on the Gas Committee of the Bradford Corporation by outsiders interested in the maintenance of steam as a source of motive power, and a certain sum was offered for carrying on experiments to demonstrate the feasibility of making and distributing cheap fuel gas, at existing gas works, for the purpose of firing boilers. This Utopian idea, as I stated in a letter which appeared in the *Journal* for Jan. 29th, 1884, was commercially an absolute impossibility. However, as it was thought that useful data might perhaps be obtained, although not precisely those desired by the promoters, the Gas Committee resolved to carry out an experiment in this direction; and as plant to make water gas would have been too expensive for experimental purposes, it was decided to try ordinary coal gas deprived of its benzol. Temporary plant was accordingly erected, consisting of an old exhauster, a Livesey washer, and three or four tanks. The material used for extracting the benzol was heavy oil obtained from the tar distiller; and the *modus operandi* was as follows: The gas was pumped out of one of the gasholders on the works, and forced through the oil in the washer, by means of the exhauster, and then passed into a small gasholder where it was stored. To make the washer more effective it was placed inside one of the tanks, and surrounded with a freezing mixture of ice and salt; and the oil was allowed to run constantly through the washer. In this way about 70,000 cubic feet of gas were treated, when, by an arrangement of the connections, it was pumped through the washer again; the partially benzolized oil being this time used in the washer. This was continued until the illuminating power of the gas had been reduced to 11.5 candles, and the composition had been altered to—

	Per cent.
Hydrogen	51.0
Marsh gas	38.0
Ethylene, etc.	3.0
Carbonic oxide	5.0
Nitrogen	2.0
Carbonic acid	0.5
Oxygen	0.5

The gas then possessed a calorific value of 22,000 units per pound, or 637 units per cubic foot. The quantity of benzol extracted was equal to 2.8 gallons per 10,000 cubic feet of gas treated; and this was quite as much as could be expected with such crude apparatus.

After getting the debenzolized gas into the holder, I left Bradford for Dewsbury, and am indebted to my successor (Mr. C. Wood, the present Manager of the Thornton Road Gas Works) for the following additional information: On Aug. 7th, 1884, the experiment for which this preparation had been made was carried out. The gas was conducted by means of a six-inch pipe to the premises (which were closely adjoining) of the firm desiring the information; passing, on its way, through a 600-light meter. It was applied to a new Galloway boiler, 30 feet long by 8 feet in diameter, furnished with an economizer, and supplying steam to one horizontal 25-horse power engine, and one beam 18-horse power engine. The boiler was a first-class one; but the engines were, in efficiency, very much behind those now constructed. The two together—boiler and engines—may, however, be considered as a fair average of the standard obtaining in practical working. Both coke and gas were used together during the experiment, the coke being fed in the usual manner, and the gas passing into two iron boxes cast to fit in between the furnace doors and the tops of the tubes, and then escaping into the furnace just above the coke, through a series of ¾-inch pipes screwed into the iron boxes. This was certainly not the best way in which the gas could have been applied; but it was an arrangement designed by the promotors, and would doubtless have been considerably improved upon had the first experiment held out any hopes of ultimate success. The experiment lasted 5¾ hours; the mean indicated horse power of the engines being 136.2. The gas consumed amounted to 67,711 cubic feet, and the coke to 1,008 lbs.; being 11,776 cubic feet of gas and 175.3 lbs. of coke per hour, or—

$$\left.\begin{aligned} \text{Gas } & \frac{67711}{5.75} \times \frac{1}{136.2} = 86.4 \text{ feet} \\ \text{Coke } & \frac{1008}{5.75} \times \frac{1}{136.2} = 1.2 \text{ lbs.} \end{aligned}\right\} \text{ per indicated horse power per hour.}$$

The expenditure of fuel was—

Gas $= 86.4 \times 637 = 55{,}037$ calorific units.
Coke $= 1.26 \times 12000 = 15{,}120$ " "
Total..... 70,157 calorific units.

The energy of fuel realized in the engine was—

$$\frac{33000 \times 60 \times 100}{70157 \times 772} = 3.6 \text{ per cent.}$$

On the previous day (Aug. 6), under exactly similar conditions, the boiler being then fired with coal, 6,402 lbs. were used in 7.5 hours; the indicated horse power being 142.8, or 5.98 lbs. per indicated horse power per hour, and the energy utilized 3.3 per cent. The relative values of coal and gas for firing boilers, according to this experiment, were therefore as follows:

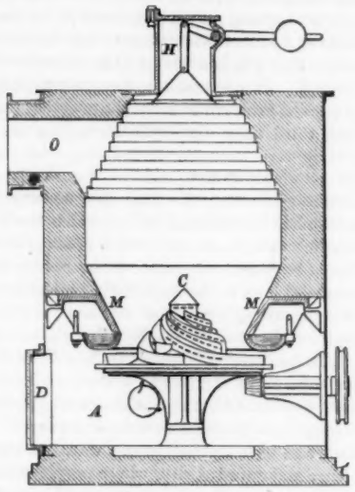
Coal, 5.98 lbs., at 7s. per ton	=	0.2242d.
Gas, 86.40 cubic feet, at 2.2d. per 1,000 cu. feet	=	0.1905
Coke, 1.26 lbs., at 5s. per ton	=	0.0337
		0.2242d.

Or coal gas would have to be sold at about 2¼d. per 1,000 cubic feet to be able to compare, in point of economy, with coal for the purpose of firing boilers. This was, of course, an absolute impossibility with either coal gas or gas of any other description whatever; and this one demonstration, therefore, proved sufficient to satisfy, if not to gratify, the promoters.

Although it is evident that it is utterly impossible to abolish the smoke caused by boiler firing by any scheme for distributing gas from central stations, yet it is possible to fire boilers in such a way as not to cause a particle of smoke, and at the same time obtain considerable economy over the ordinary method of firing with coal. This can be accomplished by using coke instead of coal as fuel. Coke is now used to a small extent for boilers; but as, when used in an ordinary furnace, the evaporative duty is too small (owing to its slow combustion), its use is very restricted. Ordinary mill boilers require the consumption of from 4 to 5 cwt. of coke per hour to generate sufficient steam for the work that is generally required of them. This is not possible with the ordinary furnace, but it is very easy of accomplishment if gas-producers are used for the purpose. In a letter published in the *Journal of Gas Lighting* for Jan. 29, 1884, I gave an account of some experiments which a friend of mine had made with a producer of his invention, with the object of showing its advantages for firing boilers. The experiments were tried at a large mill in Bradford, the producer firing one set of seven boilers, each 28 feet long by 7 feet diameter. Tried first with coal, my friend was able to keep up an ample supply of steam, and to show a saving of about 15 per cent. This was very favorable, as these boilers were fitted up with all the modern improvements of economizers, mechanical feeders, etc. Without economizers, and fired in the ordinary way, he has been able to record as high a saving as 33 per cent. Using coal, however, had one drawback. There was still a certain amount of smoke produced. I accordingly suggested using coke. This completely cured the smoke; and, to our surprise, we were able to evaporate more water and generate more steam than with coal. This was very encouraging; and we thought we had succeeded in overcoming all difficulties. We were able to gasify as much as 7 to 8 cwt. of coke per hour, and had no trouble in evaporating 400 gallons of water per hour (as tested by one of Kennedy's meters) into steam at 65 lbs. pressure; this being the duty required of the boiler. Our jubilation was, however, of short duration. The molten clinker from the coke had a terrible effect on the lining of the producer—9 inches of solid fire-brick being burnt through in a week. This quickly brought our experiment to a close; but it did not discourage my friend. With the patience and perseverance worthy of a true inventor, he set to work again; and, in the producer shown in the drawing, has succeeded in producing a machine which will, without detriment, gasify 10 cwt. of coke per hour, and enable anyone who chooses to do so, no matter how large his boiler may be, or how great the work required of it, to carry on his operations without being a

nuisance to his neighbors, and to fire his boiler without creating a particle of smoke.

The form of producer here referred to is that patented by Mr. E. Brooke, of Haigh Foundry, near Wigan, and late of Bradford; and it embodies his experience of the subject since the introduction of the Brooke and Wilson gas producer in 1876. In the producer with which the experiments were made in Bradford, the dross not only destroyed the fire-brick lining, but its



removal was a terribly distressing operation. This producer removes its own clinker; and when it is remembered that, in the gasification of 5 cwt. of coke per hour for 12 hours about 7½ cwt. of clinker would be formed, the importance of this point will be readily understood. A reference to the diagram will readily explain the manner in which this self-cleansing operation is performed. At the bottom of the fuel chamber there is a circular table, the central part of which consists of a conical grate C, having spiral steps which end in four curved arms or vanes, reaching to the outer edge of the table. This conical grate (which is perforated for the admission of air) and table revolve three or four times a day; and by this movement the dross and ashes are steadily pushed outward until they drop over the edge and fall into the ashpit below. The revolving grate is driven from some convenient source of power, for regularity and to avoid neglect (although easily turned by hand); and the effect of this is always to keep the fire in good condition, and to completely overcome what has hitherto been the condemning feature in large gas-producers. The lower portion M of the side walls, just above the grate, is formed of iron cooled by water. This serves two useful purposes—it prevents any dross adhering at this point, and ensures greater durability to this part of the structure. The revolving grate is supported on rollers carried on pillars, and is driven from the outside by a worm and wheel, the whole structure being cased with wrought iron. The ashes are raked out of the ashpit A once a day, through a doorway D provided for the purpose in the wrought iron casing, but which is kept closed when the producer is at work. The air is blown into the ashpit by a steam-jet, and finds its way up into the fire partly through the perforations in the conical grate and partly around the edge of the table. It will be seen from this that the ashes and clinker, before dropping into the ashpit, are cooled by the entering air and steam, and the heat carried back into the fire. The coke is fed in at the top by the bell and hopper arrangement H, and the whole chamber kept well filled; the gas being led off at the upper part by the branch O at the side, and carried forward to the boiler by underground or overhead flues, and ignited and consumed in the boiler furnaces. The ordinary firing arrangement is retained undisturbed, for provision in case of any derangement of the gas supply. This producer is constructed to convert about 10 cwt. of coke per hour, or equal to the supply of two ordinary mill boilers; and, with the exception of tumbling the coke in at the top, no labor is required in its attendance, as in all other respects it is self-acting.

If the public would only adopt some such apparatus as this for firing boilers, they would soon improve the sanitary condition of the large manufacturing towns, and would also relieve us of some of our surplus coke.

Most of our great thinkers, however, seem to be of opinion—and I cordially agree with them—that gas engines will replace steam largely as the source of motive power in our manufacturing towns. There seems, indeed, to be no reason why gas engines should not be able to perform any work which can be done by stationary steam engines. The only drawback to their more general adoption at present is the vital one of expense. Beyond a certain power, with ordinary coal gas, it cannot be claimed that they are economical. With water gas, however, at 6d. per 1,000 cubic feet, they compare favorably, in point of economy, with the largest and best constructed steam engines. In a letter which was published in the *Journal of Gas Lighting* for May 18, 1884, I endeavored to show how the wealthy gas corporations might assist in the development of the gas engine; and perhaps the growing depreciation in the values of our residuals may in time convince us that a "pushing" policy is as necessary for gas supply as for any other industry.

I daresay that the most general objection to any scheme for supplying gas specially for fuel purposes is the necessity which it would involve for duplicate mains. But when it is considered that in a manufacturing town, consuming (we will say) 1,000 million cubic feet of gas for lighting purposes, the engine power employed would amount to about 50,000 horse power, and that if gas engines were to supplant steam engines about one million cubic feet of gas per hour would be required, it is very evident that the existing mains would be totally inadequate; and we might just as well lay separate mains as take up and replace the old ones. Then, again, this question of mains is not so formidable as it appears at first sight. The mills in a manufacturing town are grouped together in special districts, and are generally pretty close to the gas works, as the same reasons that fix a site for gas works—proximity to railways, canals, and other modes of transit—generally fix the site for a mill; so that there would be no necessity to lay duplicate mains except in a very small proportion of the streets. The enormous quantities of gas which would be required also opens up another question—viz., whether it would not be wiser, in view of the probabilities of the future, to have several medium sized gas works within moderate distances of each other, so that they could be easily connected together by means of trunk mains of reasonable dimensions, than to have one or two immense stations at considerable distances perhaps from the area of consumption. These remarks apply simply to large manufacturing towns. In my opinion the requirements of these towns will become increasingly divergent from those of residential and commercial towns, and will require different policies on the part of those directing the undertakings.

I know that it will be urged by some amongst us that, if the public require gaseous fuel, they had better make it themselves. No doubt this will be increasingly done in large works where gas is required in sufficient quantities; but there are numbers of persons engaged in various trades who would be glad of a supply of cheap fuel gas, whose requirements are not large enough to make it pay to supply themselves. These, and the users of power, are our prospective customers. It must not, however, be supposed that I would advise any gas undertaking to rashly enter upon this new line of business. As I stated in the first letter which I wrote on this subject, what I would advise gas companies and corporations to do would be to increase, in the first place, by every means in their power, the consumption of coal gas for purposes other than lighting. Then, when an adequate market has been created, it will be for us to decide how best to supply it; and if the discussion of the problem at this stage should assist us in arriving at a sound decision in the matter, sufficient justification will have been found for the production of this paper. Some towns, I am aware, are already doing their best to thus widen the basis of their business; and all honor to them. Some are letting out gas stoves on hire; some have, I believe, even gone so far as to let out gas engines on the three years' hire system; while others are selling coal gas for fuel purposes at a cheaper rate than usual. One of our greatest authorities, Mr. George Livesey, has, I know, declared against the policy of differential rates. I do not wish for one moment to dispute the soundness of Mr. Livesey's views on the question, for no one has a greater respect than I have for this gentleman's judgment; but London is essentially a commercial and residential city, and it does not follow that what is "sauce" for the London "goose" is also "sauce" for the provincial "gander."

I am glad to acknowledge the abnormal amount of enterprise which has been exhibited by the owners of gas undertakings during the past twelve months. Gas exhibitions have been held all over the country; and the knowledge thus disseminated of the advantages of gaseous fuel as applied to domestic purposes must have had an extremely beneficial influence on the development of this important question. As one of these exhibitions was held last year at Dewsbury, it may not be uninteresting to describe the result. The exhibition was opened on July 29, and lasted a week. During the previous twelve months the consumption of gas had shown a uniform decrease, amounting on the year to about 1¼ per cent. This decrease was maintained right up to the week in which the exhibition was held. We then gradually began to "turn the corner," and soon experienced the gratifying symptom of a rapid increase in consumption; this, too, being at a time when the weather was exceptionally hot and clear, and when the influence of trade, whether good or bad, was absolutely *nil*. This increase continued, and I am thankful to say still continues; having so far averaged just 10 per cent. Now, we are only able to account for 1 per cent. of this increase as being due, directly or indirectly, to the exhibition; so that we have an increase of nearly 9 per cent. for which it is not easy to find a reason. Trade is certainly not better than it was a year ago; and other things, such as pressure, are the same now as they were then. I am therefore led

to infer that the great bulk of the consumers are induced to increase their consumption (perhaps without knowing it themselves) simply through having their attention forcibly drawn to the subject. If this be so, it is another tribute to the value of advertising.

I have no doubt I shall be met by the argument that many undertakings have had just as large, and some it may be a larger increase, and yet have not held any exhibition. Perhaps so. But still the coincidence remains in our case; and if others try the effect of an exhibition, who have not already done so, there may be a similar gratifying coincidence in theirs. The present unprecedented depression in the value of residuals intensifies the importance of increasing the consumption of gas by every means which presents itself. This is the only way in which we can be compensated for the loss on what has hitherto been one of our most remunerative branches. Such, I am happy to say, has been the case at Dewsbury—the increase of consumption has more than covered the loss on residuals; and we accordingly have the gratifying result of an increase of profit, in spite of this serious derangement in one of our chief sources of revenue.

It therefore seems to me that the policy of the directors of gas undertakings is perfectly clear—it may be summed up in the one word "enterprise." Let us push every appliance by which the sale of gas can be increased, and work up by every means in our power fresh markets for the use of gas. Thus stimulating and encouraging the efforts of inventors, we shall show to the world that our minds are not altogether devoted to paying big dividends, but that we are alive to the necessities of the day, and—being quite prepared to meet the requirements of the public, whatever they may be—are worthy stewards of the noble industry which is confided to our charge.

Discussion.

The President said there were present two very distinguished American members of the Gas Institute—Mr. M. S. Greenough and Mr. Fette, both of Boston. These gentlemen had a practical knowledge of the manufacture of fuel and water gas; and he was sure the members would be delighted, not only to welcome them amongst them, but to hear any remarks they might desire to make.

Mr. Greenough (Boston), after thanking the President for the courtesy of his invitation, said he should not have been satisfied to leave the hall without protesting most politely, but distinctly, against the suggestion that the American chemists who had made the recent report on the subject of water gas had been actuated by any motives other than those worthy of men of science. He would briefly recall the circumstances under which the report was made. Competing gas companies in America chiefly sought to compete with existing companies by the introduction of water gas—fuel gas (to which Mr. Townsend alluded), mixed afterward with the vapor of petroleum or naphtha. Massachusetts was hitherto the only State which set its face against the introduction of this gas, in spite of the affirmation of chemists and gentlemen interested in its introduction that water gas was no more dangerous than coal gas, and no more detrimental to the public health. The people of Massachusetts who had examined the matter had presented various statistics of deaths arising—of course from carelessness, but at the same time deaths occurring in considerable numbers in cities where the gas was used; and these facts could not be disproved. However, as the paper just read was not on the subject of illuminating water gas, he would not pursue this matter further. Last year a determined effort was made in Massachusetts to repeal the law which now interfered with its sale, and the result was that the State Senate appointed two professors of the Institute of Technology (an Institute second to none anywhere)—the Professor of Chemistry and the Professor of Biology—to make some definite experiments on the subject, and see what the effects of this gas were as compared with those of coal gas. These gentlemen could hardly experiment on human beings, and were obliged to make use of the animals to which Mr. Townsend alluded; although, during the course of the experiments, one of the Professors had a very strong indication himself of the effects of water gas if inhaled, for in a minute and a half he was knocked over, and was afterward quite ill. After making a series of experiments on animals, these gentlemen reported that the illuminating water gas should not, in their judgment, be allowed to be used in Massachusetts; and, so far, their report had been sustained by the committee to which it was referred by the Legislature. They were the first scientific gentlemen who had made a carefully prepared report on the matter; and this report could not be gainsaid. There might be differences of opinion as to the value of the gas. It was brighter, and in many cases cheaper than coal gas; and, in various localities, there might be circumstances which would make it desirable to use it. But as to the additional danger, there could be no question. One of the Professors testified that he went into the examination believing that the question was all nonsense—that the gas was no more dangerous than coal gas, and that the whole thing was a bugbear; but his opinion had been entirely changed in the course of the investigation. With regard to the question of fuel gas, he would simply say that there were several places in America where it had been tried; but he had yet to learn of anywhere where it had been a success. The statement made with regard to the intensity of heat produced by fuel gas as compared with coal gas, was quite new to him. It was possible that, in certain circumstances, it might be of material value; but he knew of a very careful series of experiments having been carried out with regard to the comparative value of illuminating gas, made by various companies, and in various ways, and of different qualities, with fuel gas pure and simple. They all showed conclusively at that time that, although the illuminating gas cost very much more, it was worth the additional money in heat-giving power; and that it was cheaper to use, for heating purposes, gas at a higher price, than to buy fuel gas which could be sold at a lower sum. Fuel gas had been sold in some cities for 50 cents, or 2s. per 1,000 cubic feet. In one case the company went into bankruptcy; in the second they applied for leave to make illuminating gas, because it did not pay; and in the third they were still struggling on, and he expected soon to hear that they were changing their fuel gas for illuminating gas. One point it might be worth while to mention, in case the thing should be tried. The pipes through which the fuel gas was supplied were much smaller, and it was supplied at a higher pressure, which would largely decrease the cost of distribution. If fuel gas had a smell of some kind put into it, so that its leakage could be perceived, there was no reason why it should not be supplied. It was used only in the daytime in buildings where, as a rule, it would generally be connected with the chimney; and the risk of danger would thus be much less than when employed to illuminate houses. With regard to this point, he had known of hotels in New York where a man was employed all through the night to go round to every room in the house, open a slit in the door, and ascertain whether the gas was escaping into the room. If the gas was escaping he broke the door open and dragged out the inmates; and in some cases life had been restored in this way. It was useless to deny the fact that in a large and crowded city, where people would go to bed "a wee fou," and perhaps blow out the gas, there would be a number of people who would lose their lives if the ordinary elements of illuminating gas consisted of from 30 to 40 per cent. of carbonic oxide. With regard to fuel gas, the question was entirely different.

Mr. Denny Lane (Cork) asked the author of the paper whether all the nitrogen of the air was mixed with the gas in his producer.

Mr. Townsend replied that it was; it was simply ordinary producer gas.

Mr. Lane said this was essentially different from water gas. The tests that had been made by Messrs. Crossley showed that producer gas had about one-fifth the heating power of ordinary coal gas; and it would therefore require either much larger mains or much greater pressure. He would take this opportunity of replying to a remark on his own paper, which he had omitted to notice—viz., that he did not make any mention of compression in the gases. Now, the principal benefit which could be obtained from compression in a gas engine was that it would enable one to inflame or explode a mixture containing less gas than would be necessary at atmospheric pressure. With a mixture of producer gas at the ordinary temperature, it was necessary, when a gas engine was used, to compress the gas in the first instance to about 45 pounds, instead of to 30 pounds, which was the usual pressure employed with coal gas.

Mr. J. Head (London) said he hoped the members of the Gas Institute would not consider that apparatus of the form shown on the diagram was necessary for producing a smokeless flame in a boiler. There might be a certain amount of convenience in the moving parts at the foot of the producer which was proposed for making gas from coke; but, from his experience, he should say that such an iron structure placed in the midst of a fire would be very unstable. Further, he would say that, although coke could be used advantageously for firing boilers without producing smoke, recourse need not necessarily be had to this fuel for the purpose. Mr. Siemens accomplished the same object by means of perfect combustion, utilizing the heat in two stages—first the radiant heat from the flame, and then the heat from the products of combustion by bringing them into contact with extended surfaces. The tube in which the gas was burnt must be free from obstructions; and a confining ring being put at each end, and perhaps another in the center, whereby the flame was prevented from coming in contact with the boiler plates, combustion free from smoke was obtained either with gas from coal or from coke. At the same time a higher temperature of flame was secured; for when flame touched any part of the boiler surface (the other side of this surface being in contact with water), a great depression of temperature and loss of effect occurred. In the case of a boiler fired with gas made from coal, contact of flame with the plates would produce smoke, representing loss of effect; and although, if the gas used were made from coke, no smoke would be visible, the same loss of effect would occur, as a portion of the combustible gas would escape unconsumed.

Mr. Corbet Woodall said he was not surprised that when, at the conclusion of his paper, the author desired to point the ways by which the business of gas companies was to be increased, he departed from the subject-matter of his paper, and came on to lines more in accordance with the ordinary practice of gas making. In the closing sentence he referred to the advantage of

exhibitions of gas apparatus, and of considering better means of supplying gas for motive power, and the various other ways in which gas as ordinarily made could be used. These were the directions in which good was to be done, rather than the dual service described (but hardly advocated) in the paper. Interesting as it was from a scientific point of view, as addressed to a body of gas managers, intended, as he presumed, to lead them to consider the possibility of introducing a double system of manufacture, and a duplicate system of distribution, it had little practical value. Except that they might use the coke made on the gas works, which could just as well be sold to somebody else for the same purpose, there was no connection whatever between the two processes; and the fact that Mr. Townsend considered that it would probably be advisable in many towns, instead of distributing from one center, to have a number of works from which gas could be sent out over smaller areas, showed his own appreciation of the difficulties that were inherent to the separate system. He would not go into the calculation whereby the author had sought to show that the calorific value of ordinary producer gas was about half that of ordinary gas. In this he differed entirely from the experience and opinions hitherto expressed by those who made this gas, and who admitted that the difference was as three to one, and not as two to one. This being so, it would be necessary to distribute the gas at a pressure very much higher than ordinary, or to have the mains of three times the capacity of those used in distributing common gas for the same purpose. Now, taking the value of gas plant as divided in half at the outlet of the gasholder, though the distributing plant would be rather more than the manufacturing plant, the dividend charge on the former would amount to 6d. per 1,000 cubic feet; and if this had to be multiplied by 3, they would have something like 1s. 6. per 1,000 feet as necessary in order to pay the shareholders dividends such as they now expected from their investment in gas works. What they might very well try to do—and he was surprised that more had not been done in this direction—was to see whether or not ordinary gas, at the price at which it was now supplied in large towns, could not be used for heating boilers. It would be more convenient, and much more effective, than that described in the paper; and such business would come fairly within the scope of a gas company. He maintained that the idea of creating duplicate plant was altogether outside their business, could not be profitable, and would certainly be a cause of public nuisance and danger.

Mr. Townsend, in reply, said he could assure Mr. Greenough that nothing was farther from his thoughts than to cast any reflection on American chemists. Unfortunately, English chemists had not investigated the question; otherwise the onus would have been thrown on their shoulders. Nothing was more pleasant, in his experience at these meetings, than the brotherhood existing between them and their American "cousins;" and he should be extremely sorry if any word he had said were to prejudice in the slightest degree this harmonious feeling. The gist of Mr. Greenough's remarks was to prove that water gas was not a suitable agent for illuminating purposes. There he was quite at one with him. But he (Mr. Townsend) still thought that for industrial purposes there was not the slightest danger with it. The instances he gave in which it had not been successful were, he took it, in commercial or residential towns; and he quite admitted that there was at present no chance of success for fuel gas except in industrial centers. This also met, to a considerable extent, the argument of Mr. Corbet Woodall. He (Mr. Townsend) had particularly endeavored to point out the difference between the requirements of the two classes of towns, residential and manufacturing. He hardly grasped the point of Mr. Lane's remark. The producer was not intended to make gas for distribution, but simply to gasify coke for firing boilers *in situ*. With regard to Mr. Head's remarks, no one had a higher appreciation of the Siemens producer than he (Mr. Townsend) had; but he did not think Mr. Head would claim for it that it was a suitable agent for gasifying coke for firing ordinary mill boilers. Mr. Head said it had been done; but he (Mr. Townsend) had been speaking simply of matters of fact.

The President said that they were greatly obliged to Mr. Townsend for giving his views on this question, and for the pains he had taken in preparing the paper. He believed the reading of it had been good for them all, whether they entirely agreed with the views he enunciated or not, because it would perhaps enable them to come to a decision on this question in the near future.

Examining the United States Patent Office Records.

By Frederic Egner.

"*Class* 48.—*Gas.*"

The above is the official appellation given to one of the great divisions of the United States Patent Office; and this class is of especial interest to the gas maker who is desirous of informing himself—and thereby keeping himself informed—with regard to what is being attempted by inventors in the matter of advance in the field of his profession. This great class is divided into 21 sub-classes; and in order that the reader may have some idea as to what has been done in the way of patenting so-called improvements in the manufacture and distribution of gas, the number of patents issued in each subdivision, from the year 1798 to 1885, is here given:

Number of Sub-Class.	Subject.	Number of Patents Issued.
I.	Anti-combustion	7
II.	Carburetors	618
III.	Carburetors and jet mixers	73
IV.	Center seals and bye-pass valves	9
V.	Coal gas	34
VI.	Coal and oil	18
VII.	Coal, oil, and water	52
VIII.	Coal and water	22
IX.	Dip-pipes	55
X.	Exhausters	12
XI.	Gasholders	30
XII.	Hydrogen	64
XIII.	Oil	67
XIV.	Oil and water	195
XV.	Purifiers	153
XVI.	Retort lids	49
XVII.	Retorts and settings	258
XVIII.	Retort chargers	49
XIX.	Water (alone)	80
XX.	Wood	47
XXI.	Gas distributors	2

—or total number of patents issued (or total of those granted that relate to the science of gas making) during the period of time metioned equal to 1,893. Since the 1st of January, 1885, over 100 patents have been granted either for improvements on old or securing protection for entirely new processes and devices, embracing leak detectors, purifiers, systems of laying gas mains, etc.

The most interesting of the sub-classes at the present time is No. XIV., as it contains an enumeration of all the inventions covering the descriptions or sorts known as water gas apparatus. A careful study of the inventions in that class leads on to surprising results. It seems almost as if every possible point that could be claimed had been covered by the various inventors; yet not a month passes but some really novel feature is brought to light. Indeed, the march of improvement in gas making can nowhere else be seen to better advantage than by looking over the numerous inventions shown in "Class 48." Most of the earlier devices would now only cause a laugh if put on exhibition and brought before the critical inspection of the educated gas man of the present day; and yet the few meritorious inventions shown have clearly paved the way, step by step, to the nearly perfect apparatus we behold in the comparatively few thoroughly well equipped gas plants of our time.

It would be well for those who are consumed with the inspiration or idea that they have discovered a new and useful feature in gas making, and who intend to apply for a patent on such inspiration, to first carefully look over the field and see what has been done therein. It would mean many dollars to the "inspired," without mentioning anything at all about the saving in bitter disappointments, if this prudent course were followed.

To say the least, numbers of the devices under which gas is to be made are curious and often ridiculous. For instance, the drawings and specifications of Patent No. 291,463 outline a method under which the action of a dynamo-electric machine, driven by a gas engine, decomposes water into its primary elements. The oxygen is disposed of by uniting with the carbon electrodes employed, and the hydrogen is set free, carbureted, and stored as usual. A similar device was patented some 20 years before; but, instead of the dynamo feature, electric batteries were employed to effect the decomposition.

The gradual approach to perfection made by the various inventors and improvers of gas apparatus can also be clearly traced in looking over the files of "Class 48." The early efforts of the water gas patentees look very crude when placed alongside of their efforts of later date, or as we now see them.

Not a bad idea in the matter of making coal gas is shown in Patent No. 118,579. The only drawback to it is that its practical demonstration would require the expenditure of a large sum of money. For all that, it really appears feasible and promising; and it might be said that it is one which seemingly contains all the elements of success. Gas is to be made from coal dust and superheated steam—the material to be fed into a tall vertical retort. In the writer's opinion, no one who will carefully look into the matter can help feeling favorably impressed with it. The purifying feature of the same patent is not so good. The process would only do for the larger class of works, or when not less than 100,000 cubic feet per day is made.

Another inventor proposes to decompose water by means of heat and zinc. The oxygen would, with the zinc, form the oxide of that material, or the basis of a valuable paint; and the hydrogen would unite with hydrocarbon

vapors (which were to be present), and thus form a rich illuminating gas. That patent expired six or seven years ago; and, being now public property, anyone who may wish can try it. The name of the inventor was Elmer, but the number of the patent I do not now recollect.

It is, however, not the dead, but the live patents that interest us the most just at present; and as the writer has given them some attention, he may at some future period give the results of that investigation to the (gas) public through the columns of the JOURNAL. In view of the fact that—and not so very long ago either—a combination of all the water gas patentees had been threatened, it may not be lost time to see what really is or is not public property, so far as patent rights have anything to do with the question; and in the opinion of the writer an inspection of "Class 48—Gas," will be found well worth the time spent in making the examination.

A Review of the Report on the Efficiency and Duration of Incandescent Lamps.

By H. C. ADAMS.

The special committee appointed by the Franklin Institute last fall to determine the efficiency and duration of incandescent lamps has at last completed and presented its report. The work of the committee was, of course, simply an outgrowth of the Electrical Exhibition held at Philadelphia under the auspices of the Institute one year ago, and the time that has elapsed seems to warrant an expectation that the work has been thoroughly done. The anticipation is fully justified by an examination of the report, which is the most complete that has yet appeared upon the subject; and for care and scientific accuracy we do not believe the methods pursued could well be excelled. In view of all that, and of the increasing prominence of the incandescent lamp in the field of illumination, we feel that a short review of the report will be read with interest.

It was the aim of the committee to determine, first, the efficiency of each lamp; second, its life; and, finally, the relation between the efficiency and duration. The efficiency of the lamps was determined in a series of what were called preliminary tests. The candle power was determined in a series of most elaborate photometrical measurements. The instrument used was a standard Letheby-Bunsen photometer with a 60-inch bar and a Methven standard 2-candle slit. The electrical conditions were carefully measured and adjusted; so that each lamp should be tested at its normal potential. Then each lamp was measured in 65 different positions. First the lamp was placed with its carbon's plane vertical—that is, in its normal position as seen in general use. Then a measurement was made at every 30° of its equator, the lamp being revolved to the proper points, and, for clearness of explanation, being considered as a sphere. The mean of those measurements was held to give the "mean horizontal intensity." The lamp was then rotated vertically, and measurements again made at every 30°; and these were repeated at every 45° along its equator. These vertical measurements combined with the horizontal ones, and their mean ascertained, were held to represent the "mean spherical intensity." The light given off at the different points on the globe of the lamp is graphically shown in the report by a series of curves. From these it is seen that, with a circular filament, the light distributed horizontally is nearly constant in all directions; but with a rectangular filament the greatest amount of light is given off in the direction toward which the longest side of the rectangle is turned—or, briefly, the horizontal distribution is dependent on the cross-section of the carbon. It is seen, also, that the light given off from the top of the lamp is very meager; that of course, being dependent on the position of the carbon there, and varying, in the different makes of lamps, from 3 to 13 candles.

The following is a summary of the preliminary tests. [We should state here that the only lamps entered for examination were the Edison, Stanley, Woodhouse and Rawson, White, and Weston; the Brush-Swan and Bernstein lamp makers declining to enter the lists.]

	Number of Lamps.	Volts.	Candle Power. Mean Spherical.	Mean Horizontal.
Edison	31	97.57	15.47	19.24
Stanley	14	96.56	13.59	16.30
Stanley	11	43.98	13.42	16.44
Woodhouse and R.	11	55.53	15.64	18.68
White	10	49.99	12.44	15.05
Weston	24	111.42	16.43	18 07
Weston	10	70.40	15.18	16.85

The lamps were selected at random from lots forwarded by the manufacturers. The Edison lamps were the most uniform; but the highest average efficiency was obtained from the 44-volt Stanley lamps.

The same careful precision and patient labor that marked the preliminary tests also characterized the determination of the duration of the lamps. A room was set apart for the purpose, the door of which was locked and sealed upon the completion of each day's operations. An assistant examiner and a watchman were in constant attendance day and night. A separate record was kept of each lamp's performance, as shown by the daily photometrical and electrical examinations.

The length of the duration test was fixed at 1,000 hours. Of the 20 lamps entered by the Edison Company 19 survived; the life of the other lamp was 295 hours. Of the ten Stanley lamps entered one survived; the average life of the others was 360 hours. Of the 20 lamps of the Weston make, 110½-volts, only 6 survived; the life of the others averaged 206 hours. It is due to Mr. Weston to say that he protested that the lamps sent for test from his laboratory were, through some mistake, not a representative lot, and the examining committee seem to acknowledge the fact.

The following is a summary of the results of the duration test in some of the lamps that survived:

Name.	Initial Candle Power. Spherical.	Horizontal.	After 1,000 Hours. Spherical.	Horizontal.
Edison—Lamp No. 1	15.3	18.8	9.3	11.4
" " No. 5	15.7	19.5	10.5	13.0
" " No. 10	14.0	17.7	9.8	12.4
" " No. 20	15.2	18.9	9.0	11.2
Stanley—Lamp No. 30	12.7	15.4	6.2	7.5
" " No. 8	10.8	13.2	5.4	6.6
Weston—Lamp No. 3	13.4	14.8	7.1	7.8
" " No. 7	17.3	19.0	2.9	3.2

The above figures will give a sufficiently clear idea of the condition of the lamps after the tests. All of them were more or less discolored. The candle power of each lamp suffered continual depreciation as the test progressed. We observe a reaction and a gain of intensity in the lamps at different periods of the test; but the depreciation was sure, and apparently very nearly proportional to the time that the lamp was in action.

On Heating Regenerative Gas Furnaces by Radiation from Flame.

At the Annual Meeting of the Society of Chemical Industry (England) Mr. Frederick Siemens, C.E., of London, read the following paper:

In tracing the action within a flame from the moment the gases unite until the heat has been fully abstracted from the products of combustion, the flame will be found to pass through various successive periods materially differing from one another. Of these there are two, which require quite different development and treatment. The first is the period of active combustion—the essentially chemical process by which the heat is produced. The second period is after combustion has been completed, when the products of combustion alone have to be dealt with, which still contain a great portion of the heat produced during combustion. The conditions of the flame during these two periods are so entirely different that it is quite reasonable that they should be separately and differently treated, and should not be considered as one, as has hitherto invariably been the case. Whilst chemical action is proceeding the flame ought to be allowed clear space within which to burn. It should not be interfered with by surfaces of any kind, and it should be allowed freely to emit its radiant heat; whereas the products of combustion, having very little power of radiation, and not injuring surfaces upon which they impinge, should be brought into contact with the surfaces to be heated for the purpose of abstracting their remaining heat.

As is well known, combustion is interrupted when flame meets solid surfaces; whilst the solid surfaces themselves also suffer—not so much from the heat as from the mechanical action of the flame. To explain these circumstances various theories have been proposed, as well as to account for the fact that flame has great power of radiation in its first stage and little in its second. It is agreed in all these theories that the gases in combustion forming the flame are intensely excited, and that the molecules of gas are rotating around one another, or are otherwise in violent agitation. According to the electrical theory (which is the one accepted by the author), a flame consists of small but innumerable lightning flashes; and it is at once evident that a solid body brought into such a flame obstructs its action, arresting the motion of the particles of gas which strike on it, as well as by its attraction and adhesion. The molecules of the gas not being able to move, combustion cannot continue—at least in those parts nearest to the opposing surfaces. As a result, smoke is produced, enveloping the obstructing surfaces; and radiation cannot act because of its inability to penetrate the cloud of smoke in which the flame is enveloped. Then, as regards the action of the flame on any surface, it is quite natural to expect that, if flame is composed of innumerable flashes of lightning, no surface or body exposed to it can long withstand its action. The flame in its first stage being composed of innumerable lightning explosions, and carrying free carbon, accounts also for its radiant power. In the second stage of the flame, as no chemical action is going on, and there is no free carbon to emit heat by its incandescence (the carbon being converted into invisible carbonic acid), it is quite natural that there should be little radiant action.

A flame radiates much better than a solid body, and in a different manner. A solid body radiates only from its outer surface, while a flame radiates from every point within it, and on its surface in every direction, or from every point of its entire volume in every direction. Thus the flat-flame burner produces nearly as much radiant heat and light from its edges as from its face; whilst the Argand burner serves as an illustration of a hollow flame—the light radiating outwards, not only from the outer surface, but from the inner surface through the flame itself; and heat and light obey the same law in this respect. If the area of a flame is doubled, it radiates four times as much as originally; whilst a solid body, if doubled in area, radiates only twice as much as before. A volume of flame applied for heating by radiation cannot be made too large from an economical point of view, because the radiation from a body of flame increases, not according to its outer surface, but in proportion to its volume. The reason of this is that each particle of carbon raised to incandescence within the flame acts as a center of radiation, and emits its light and heat in every direction, whilst a solid body simply radiates from its surface. Thus, in the flat-flame burner, as already mentioned, the edge radiates out nearly as much light as the face, and would radiate out quite as much, only that (owing to its narrowness) some of the incandescent carbon particles come in the way of the light radiating from those behind them.

From a careful consideration of the various circumstances thus set forth, connected with the production and action of flame, the author has designed a furnace, now well known as the radiation furnace, a short description of which in some of its applications will be given later on.

In order to employ radiation in the most profitable manner, a gas rich in hydrocarbons should be employed, for the production of which special forms of gas producers may be adopted with advantage. Of these there are two so far employed. One of these was described by the late Sir William Siemens in his paper, "On the Use of Coal Gas as a Fuel," read before this Society on June 29th, 1881. This producer may be shortly described as consisting of a cylindrical chamber truncated towards the bottom, which is filled with coal through a large hopper at the top. This chamber is formed of an iron casing, covered on the interior with a lining of refractory material, and in this lining passages are arranged all round for the exit of the gases. A large opening at the bottom admits of the withdrawal of ashes and clinkers that may be formed in the combustion of the fuel; and a blast (which, by preference, should be heated) is directed right into the very heart of the mass of fuel. The result is a very high temperature in the center of the mass; one of the essential conditions for the total conversion of coal into combustible gas being a maximum degree of heat at one portion of the process—and no heat is lost at that point, which loss would interfere with the due conversion of carbonic acid into carbonic oxide. At the same time, water, which is admitted by a continual streamlet into a pan near the bottom, is evaporated by the radiant heat of the fire, which is thus utilized; and currents of steam are directed or drawn into the apparatus, passing through the zone of highest temperature towards the center of the mass. They there become converted, by contact with the incandescent fuel, into carbonic oxide and hydrogen (free from nitrogen), which add greatly to the calorific effect of the gas produced.

The modified form of the Siemens old-type producer, which is also employed for the purpose of enriching the gases by transforming the heavy hydrocarbons which would otherwise form tar on condensation, is described in a paper read by the author's principal assistant (Mr. J. Head), before the Iron and Steel Institute, in May last. The gas producer is divided into two compartments, one of which receives the hydrocarbons (the volatile constituents of the coal), and the other the carbonic oxide formed by the decomposition of its solid carbonaceous matter. The proposed separation may be conveniently carried out by means of a curtain wall placed over the fuel, and by providing a separate outlet for the hydrocarbon constituents from the chamber thus formed.

That gases may be enriched by converting the hydrocarbons into permanent gases was determined by the late Sir William Siemens in the following manner: A certain quantity of gas was collected in a graduated receiver from one of the Siemens old-type gas producers. This gas was taken immediately above the fire through one of the stoking-holes, and was found, on cooling to atmospheric temperature, to be reduced in bulk from 120 cc. to about 85 cc.; the apparatus being at the same time much coated with tar. The receiver having been cleansed with spirits of wine and washed with water, another sample of gas from the same producer was taken, with this difference—that, on its way to the receiver, it was passed through a combustion tube, which was heated by a spirit lamp. The same volume being collected as before, the weight of gas taken would be somewhat less than on the previous occasion; and had the gas, on cooling to atmospheric temperature, been reduced to the same bulk as previously without a deposit of tar, the result would have been considered satisfactory. But a better result even was obtained. For the loss in bulk was only about 20 cc.; the receiver being comparatively free from tar. It is much to be regretted that time would not allow of analyses of the gas obtained under these conditions to be made; but gas made from Staffordshire coal, in the Siemens' old-type gas producer, has been found to contain less than 35 per cent. of combustible elements when working at its best; whereas, gas made from the same coal in one of the Siemens' new-type gas producers, when the desired conditions for conversion of tar into permanent gases are present, has been found to contain 48 per cent. of combustible elements.

In some works it may be found convenient after the treatment of the hydrocarbon gases for tar and ammonia, to utilize some of them for illuminating purposes. Owing to the inferior description of fuel usually employed in gas producers, as compared with that used at gas works, the illuminating power of the hydrocarbon gases may not be found equal to the standard of the gas supplied by gas works. But larger or additional burners can be used; and by this means manufacturers may almost entirely save their gas bills. Taking each burner as consuming 7 cubic feet of gas per hour, even 100 such burners, lighted for 12 hours each day, would not consume all the hydrocarbons liberated from a ton of coal. Moreover, the quality of the illuminating gas could be improved by adding a little cannel coal to the fuel charged in the gas producers, or in some of them, during the time that the gas is required to be used for illuminating purposes; and this will afford an alternative method to the employment of larger burners, or a greater number of smaller ones. The gases not required for illuminating purposes should be returned to the main gas flue supplying the furnaces. Indeed it is not desirable to use gases consisting mainly of carbonic oxide and nitrogen in regenerative gas furnaces, where the new method of heating by radiation is adopted, for which, as has been explained, gases rich in hydrocarbons are better.

In designing the regenerative gas furnace, in which radiant heat is to work to the best advantage, it is necessary that the gas and air ports shall open at some distance below the roof of the melting chamber, and at some distance also from the side walls; so that the inflowing gas and air may have unobstructed space after ignition for entering into combustion, and for the free development of the flame. For the same and other reasons the flame is kept as much as possible out of contact with the materials on the surface bed; and when these are crucibles, ingots, blooms, or packets of iron, they should be so placed that the radiant heat may play freely upon and about them.

This new system of applying heat within the modified regenerative gas furnace has now been employed for a sufficiently long period to establish the economy of the method, as well in regard to the fuel used as to the material of which the furnace is constructed, and that treated on its hearth. One of the latest and most interesting applications has been to the open-hearth steel-melting furnace. Various steel works throughout the country, and several glass works, are now modifying their furnaces so as to obtain the benefits offered by this new method of heating. Another important application of this method of heating is to forge, mill, and puddling furnaces; as, owing to the absence of contact between the flame and the materials with which the furnace is charged, a great reduction in the loss of metal which has hitherto occurred through oxidation will be effected.

In steel re-heating furnaces, contact of the flame with the ingots produces red-shortness in the metal, exhibiting itself in fissures, particularly at the corners of the ingots or blooms, when these are subjected to treatment either under the hammers or in the rolls. The removal of the injured portions involves a stoppage of the operations, resulting in a waste not only of material but of time also, and occasionally rendering the blooms entirely useless for the purposes intended. In the radiation furnace this cause of loss no longer exists; while there is also a saving due to non-oxidation of the metal. In iron re-heating furnaces the saving in waste of metal will be much more considerable than in furnaces for the re-heating of steel, owing to the higher temperature at which they are worked; and the metal will weld much more easily, as it is heated out of contact with flame. These furnaces should be made as long and wide as convenient, in order to obtain as much room for the development of the flame as possible, and for placing the ingots, blooms, or packets, sufficiently far apart to allow the radiant heat to reach them on all sides.

In heating furnaces constructed and worked, as hitherto, by contact of flame with the metal to be heated, the furnaces must necessarily be made as small as possible; for the flame under such conditions parts with its useful heat in a run of a few feet, after which the sooner it leaves the furnace the better. But when heating by radiation is adopted, the conditions will be quite changed; for the flame, not being brought into contact with surrounding objects (including the metal to be heated), will be kept at a uniform temperature throughout its course, radiating all the time the maximum heat required for the charge in the furnace. And when combustion has ceased, the hot gases will be deprived of their remaining heat through contact in the regenerators. It will, perhaps, be difficult for those accustomed to heat metal by contact with flame, to realize the possibility of effecting the same object better, more quickly, and more efficiently by means of radiation; but, to overcome the difficulty, it is only necessary to associate heating by

radiation exclusively with the regenerative gas furnace, in which both gas and air are raised to a high temperature before combustion, as without such initial heating a flame of high temperature, and one therefore capable of radiating intense heat, could not be obtained.

The new method of heating by radiation from flame offers the solution to an objection which has sometimes been made against the regenerative gas furnace on the ground of its great cost, which has certainly limited its application for heating furnaces in this country. But when a few, or perhaps one furnace only, will be built for a mill, the capital expenditure on furnaces even with separate boiler settings, should compare favorably with the cost of the old grate furnaces and boilers. Moreover, they will offer the advantages of saving in fuel, in wear and tear, and in metal. Manufacturers who think that the suggestion which has been made is in advance of the times, and who might doubt the possibility of obtaining a flame of such a considerable length as would be required for a furnace to heat 100 or 200 tons of metal per day, will be pleased to learn that the problem has been already solved by the author in connection with the manufacture of glass. There exist many furnaces of the dimensions now foreshadowed for heating iron and steel, some of which have a run of flame upwards of 40 feet long; and one of them, measuring 42 feet by 16 feet 6 inches, inside dimensions, and holding 130 tons of glass, is capable of producing 24 tons of glass per day, or at the rate of a ton of glass per hour, the consumption of fuel being about 18 cwt. per ton.

Another most important application of this new system, for the greater extension and improvement of which trials are now being made, is to the heating of boilers by means of gas; but, in order to obtain the greatest benefit from this method of firing, it is necessary that there should be use for the gas made in the producers by night as well as by day. If flame is allowed to touch the sides of a boiler, there is of necessity smoke produced on its outside surfaces, and the radiant heat of the flame not being able to penetrate such an atmosphere of smoke, the water in the boiler cannot get the advantage of it. It will readily be perceived how great a quenching effect the metal of the boiler has upon a flame, when it is remembered that the temperature of steam—which is, of course, that of the boiler—is only 311° F., even at 60 pounds pressure, whilst that of the gaseous flame in contact with it is about 2,000° F. In this application the principle has been followed of allowing the active flame to have free space for its development, and for the radiation of its heat within the length of the tube, and not allowing it to touch the sides until after complete combustion has been effected, when the products of combustion may be brought into direct contact with solid bodies. A boiler fired in this manner lasts longer, as the plates are worn away more readily through direct contact with the flame than from any other cause. As the remaining heat of the products of combustion come into direct contact with the sides or flues of the boiler and its regenerators, it is completely utilized, and the maximum of heating effect is thus insured. In various applications that have been made, a saving in fuel has been effected which varies from 25 to 30 per cent. These results, however, apply to ordinary horizontal-flued boilers, to which only this method of heating has been so far applied; but a vertical boiler is being constructed by the author, specially designed for the application of the new method of heating, from which it is expected that even better results will be obtained.

Another application of the new method of heating, which has been kindly suggested by Prof. Armstrong, F.R.S., is to the manufacture of coke in the ordinary beehive oven. A furnace for this purpose would be very similar in construction to the glass-melting furnace of horseshoe form; the flame radiating heat of a very intense character upon the coal to be carbonized, and the gases being drawn away below the bed of the furnace by means of an exhauster, in the usual manner. In order to prevent the flame being drawn down by the action of the exhaust, small coal (mixed, perhaps, with tar) should be charged on the top of the mass of coal to be carbonized, so that on heat being applied it would bind the upper surface, forming a skin impermeable to the passage of gases. The gases withdrawn from the bottom of the furnace may be led away for the removal of bye-products, and then re-delivered to produce the heat required for carbonization, and also utilized for other purposes.

There must be several applications of this new method of heating to the chemical industries which should offer important advantages. In some cases gas has been used with the sole object of avoiding the introduction of ashes or dust into the furnace; but where contact of the flame is not necessary, as regards the chemical operations performed, the new method of heating by radiation—first within the heating chamber, and contact afterwards with extended surfaces—will be a step in advance of the mere application of gaseous fuel.

Paper Made from Seaweed.—It is reported that a Japanese inventor has discovered a process of making paper from seaweed. It is thick in texture, and owing to its transparency can be substituted for glass in windows, and when colored makes an excellent imitation of stained glass.

Mr. A. F. Upton Discusses the Relation of Steam Power to Electric Lighting.

During the progress of the semi-annual meeting of the National Electric Light Association, held in New York city last August, Mr. A. F. Upton, President of the Jarvis Furnace Company, of Boston, Mass., delivered the following remarks on the above-named subject:

The principal thing to my mind in regard to electric lighting is the power, and then comes the cost of power. I have always claimed, from my own experience, that the matter of power in regard to electric lighting was figured, in one sense, on a wrong basis. My idea, in order to get at the bottom of electric lighting, is that the cost of power should be most carefully looked to. The only thing to be considered is the actual price per lamp per hour—not evaporation or pounds of coal per hour. It is the actual cost of running an incandescent lamp per hour. The first question that would come in in regard to that would be fuel. In selling lights you are selling power. That is always to be kept before the mind. In carrying out that line of argument I propose to state my own experience. Believing that electric lighting had come to stay, we devoted all our energies toward getting up the most economical plants we possibly could. We decided to use direct-acting engines—that is, direct belting, not using long-stroke engines. That was our experience in watching several stations at the start, and in the stations that we subsequently equipped we adopted the Armington and Sims engine. In regard to boilers, we have finally settled on using a plain steel tubular boiler. The sizes we are generally putting in now is 6 x 16 and 140 3-inch tubes, giving us 120-horse power. At the Edison station in Brockton, Mass., with a boiler of that size and that engine, 150-horse power, with 80 pounds of pressure, we have run between 1,500 and 1,900 10 to 16-candle power lamps of the Edison system. We used cheap fuel. In a test taken with a sectional boiler, it showed an economy of 22 per cent. as regards using soft bituminous coal.

The principal point we have made in regard to fuel was utilizing all kinds of cheap fuel, such as screenings, soft coal, slack, cinders from locomotives, sawdust, cotton seed, waste, rice shucks. Anything that has anything combustible in it, whether wet or dry, we have used to good advantage. We have taken great pains to obtain our figures. In some cases I have got them; in others, not. There seems to be a reluctance among people to tell the figures. But the lowest I have is from the Thomson-Houston system, in Houston, Me. They are running at a fuel cost of two mills per lamp per hour. I found that the average cost on a station that we have fitted up has been (using screenings and soft coal, and using arc lamps) about 4 mills per lamp per hour. Incandescent figures I have not got. A test has recently been made where we partially fitted up stations on the Edison system. I have talked with a great many of the electric-light people, and I have tried to enforce my ideas that it is not evaporation, but the actual cost of the day or night's run that is wanted. If one man gets 50 cents, and another $3, why, the man who gets the 50 cents gets the best results. In fitting up stations I spoke of using direct belting engines. We found, in making several tests, that the power used in driving shafting has run from 10 to 15 per cent. There are gentlemen in this convention who have a plant where it took 22½ per cent. of the power to run the shaft. There is a station in the city of New York where they have been shut two weeks from the breaking of the shafts. That can never happen where direct-belted engines are used.

Another point in running direct-belted engines. As a rule, not more than 100 arc lights are put on a circuit. Now, if those are run from one dynamo or one engine, if one engine breaks down, your whole system is disarranged. In fitting up stations I simply give what we use ourselves. We use Sheffield grates; we use the "National" heater, made in New Haven. Wherever we can we use the steam damper keeping the pressure even, and keeping the draft right. I would advise all to use, where tubular boilers are used, the steam cupola. I found that where slack coal or bituminous coal is used it helps much in keeping the tubes clean. Of course, that depends very much on the engineer and fireman. I found a great deal of difference in that. In every station we have put in scales for weighing the coal. All well-regulated mills with which I have any acquaintance scale all their coal. I do not wish to enter into the question of electric lighting. That is not in my line at all. But we have done work for a considerable number of companies.

I would like to speak of one system that is working now in the city of Lawrence. We have three engines in that station. We have just sold two 10 x 12 Armington and Sims engines, 90-horse power each, to run a new system that is just in there, called the "Municipal" system. They run on that system four circuits of ten miles each. I am now talking of the incandescent system. These are 32-candle power lamps. They contract for 500 of those lamps for $650 per month. Now, it may puzzle you, but it puzzles the gas company still more, how they are going to do it. There is one other thing that has occurred to me several times that I think the electric light companies should take into consideration, and that is the letting of power. At this same station a large number of motors are used which run all day. They

run from ¼-horse power to 5-horse power. Those motors are all employed, as I understand from the parties, at a good profit, and it has always seemed to me that everyone should use their power. You have it there, and why not use it? In the Thomson-Houston station the construction of the plant is so peculiar that I think I am justified in bringing it up before the convention. It was changed so that over the station a shoeshop has been fitted up. The shoeshop is run by the engines in the daytime, and they receive as a rental for that power $2,000 a year. This is supplied by a 35-horse power engine. It does not require quite 35-horse power, because, while one engine runs the machine in the shoeshop, the other runs all the electric lights in the city. If all stations were built in that way there is not one in the country but what would hold out a very handsome profit on the surplus power they might have in the daytime.

Another point in regard to the station. There is an Edison Company started first, and afterwards a Thomson-Houston arc system, and this is the result that is given: After the incandescent started the sale of gas increased largely, and after the arc came in it increased again 10 or 15 per cent. Now, the question is asked, how did the introduction of so many arc and incandescent lamps increase the sale of gas? I can account for it in no other way than that, when one store is lighted brilliantly by electricity, the next one has to use more gas. But my experience in New England has been that every gas company has increased its sale of gas as the arc lights have been introduced. I have spoken of a station partially erected, and only partially equipped, where we set the boilers while the engines were being finished. That station was the first incandescent station that I ever examined. Instead of being underground it is all overhead, and the station, as they informed me, has been paying a profit from the start.

All gentlemen who start arc lighting do their own wiring. Contracts were made for the year, and payable monthly, so much per lamp every month, and the companies do the wiring. That, in my opinion, was the cause of the success of the station. A gentleman said to me the other day that it was not paying, and I said to him, "if any gentleman will go there and examine it carefully and look over the room, and if he says it is not paying a profit I will pay his expenses." The fuel costs 89 cents a ton.

We have had some experience in regard to electric lighting and water power in New England. But, as a rule, water power has been entirely abandoned. The trouble has been that it is not reliable. In Manchester the water has been very low several times in the last few years. In Lewiston and Holyoke it has given out altogether, and the stations there are entirely equipped with steam power. I understand there is a very successful station in Rochester running on water power.

Something About the Stevens Battery.

"If any of the millionaires who are owners of the new Queen Anne cottages at Babylon, Bayshore, or some of the other summer resorts on Long Island," remarks the New York *Times*, "were to be told their handsome woodwork finishings are merely remnants of the old Stevens battery, the statement would probably be received with many doubts. Yet such is the fact. When Mr. Stevens presented the famous vessel to the State of New Jersey, the United States government decided that a man-of-war could not be accepted as the individual property of any State. Mr. Stevens then offered it to the national government; but it was refused as being inadequate to perform the duties required of a war ship. Several suits followed this decision between the estate of Mr. Stevens and the State of New Jersey, which claimed that, although it could not hold the vessel, it was entitled to its value in money. The final decision was in favor of the State, and the Stevens battery, as it stood on the ways, was sold to Mr. William E. Laimbeer, of New York, for $55,000. He was given six months in which to remove his purchase; but for half of that time he turned it over to the Stevens Institute for the use of its scholars. In consequence, Professor R. H. Thurston was able to give his pupils three months of the most interesting practical study that has ever been available in this part of the country.

"When all the movable articles had been carted away the two pointed ends of the boat were chopped off and the immense hull, over 400 feet long, was parted by its own weight. The labor of collecting the remnants was then comparatively easy. Immense quantities of giant powder were used, however, to reduce the bulk of the iron to a mass small enough to be carted away. There remains intact to-day but one article that was used on board the Stevens iron-clad steam battery. It is a bronze bell, 4 feet in circumference. This instrument of household torture rang the working hours at the old shipyard since 1842. A cast mark near the top bears the date 1841, and it is probably the oldest bronze bell in America to-day. It still performs its duty at the country place of retiring Dock Commissioner Laimbeer, father of the purchaser of the boat, at Tenafly, N. J.

"The heirs of Mr. Stevens say that he spent $2,000,000 upon his pet project, in addition to $500,000 granted for the purpose by the government. In his will was a codicil ordering the expenditure of $1,200,000 additional, which was made under the supervision of Gen. George B. McClellan. When put up at auction this mass of iron, that had never been afloat, brought $55,000. It cost Mr. Laimbeer, in addition, $31,000 to break her up; but by selling it only as raw material he made a very handsome profit.

"The dismantling of the hull occupied the balance of the time allotted the purchaser. On no day during this period were there less than 40 men at work, and at times the number ran up to 100. The woodwork was all found to be of the finest Georgia pine in a high state of preservation. That used in the sides of the hull was in layers of a thickness of 5 feet 6 inches. These layers were dovetailed together and secured by bolts 4 feet long. In and around these joinings creosote was packed in large quantities, and although this wood had been in place for more than 20 years, it was found to be in better condition than when freshly cut. All the skill of the workmen and the strength of the tools could not force the layers of wood apart, and the work was finally done by burning. It was found to be exceedingly dry and susceptible of high polish, and, as has been stated, a large quantity of it has been used in the new cottages built and building on the south shore of Long Island.

"From the hold were taken two engines of 6,000-horse power, each made expressly for use in a twin-screw vessel, and therefore worthless. They were broken up and sold to the Delamater Iron Works, from whence they came. In addition to the two propelling engines there were sixteen driving engines, which were preserved intact and taken to coal mines in Pennsylvania, where they are still used as superior to any new inventions. Over 2,000 tons of iron plate were taken from the battery and sold to the Catasauqua Iron Works, in Pennsylvania, and 33 per cent. of it was rerolled in this country. The balance was sent abroad. The bolts used in the construction of the vessel were made in Scotland for that purpose, and possessed unusual tensile qualites."

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Annual Meeting of the Providence (R. I.) Gas Light Company.—The thirty-eighth annual meeting of the Providence Gas Light Company was held at the offices of that corporation on date of Monday, September 7th. An excellent attendance on the part of the stockholders is reported. President Barstow occupied the chair; and the report of Secretary Slater, covering the operations of the Company for the twelvemonth, was listened to with great interest. The financial showing made was eminently satisfactory, and this sound old corporation enters upon its next year of life and activity under the most pleasing and promising auspices. We hope to give Mr. Slater's document in a future issue of the Journal. At the election for a board of directors the following-named gentlemen were selected: Messrs. William Goddard, Amos C. Barstow, Alpheus B. Slater, Royal C. Taft, Edward Pearce, Jesse Metcalf, Amos N. Beckwith, George W. R. Matteson, and Lucien Sharpe. At the directors' meeting, held immediately after adjournment of stockholders' assembly, the board was organized by the election of the Hon. A. C. Barstow as President; Col. William Goddard, Vice-President; and "Old Reliable," Mr. A. B. Slater, as Secretary and Superintendent. Evidently the people interested in the doings of the Providence Gas Company are pretty well satisfied with the way in which things were managed last year, since the above-named officials were chosen as their own successors.

Reported Trouble Between English Meter Makers and their Employees.—It was rumored some time since that there was great likelihood of trouble between the English meter making firms and their employees in respect to the question of a reduction in wages; and in fact it was reported that all the large concerns at Oldham had taken steps to put a new and reduced scale in operation there. This, it seems, was not really the case, although it is more than likely that the subject had been discussed by employers. A late issue of the Oldham *Chronicle* contained the following in reference to the matter: "A paragraph which appeared the other day, in regard to the wages question among the meter makers employed in Oldham, to some extent conveyed the impression that a movement for a reduction had been instituted at the various works in the town. Such, though, is not the case, notice of reduction having been given at one establishment only, and this to an extent that has induced employees to leave, as their work was finished. With this exception the wages of the gas meter makers are not likely to be interfered with, for the present at all events."

One of the Reformers Again "Bobs up Serenely."—We notice that a rather loosely named "band of benefiters," hereafter to be known as the "Gas Consumers' Benefit Company of the United States," filed its certificate of incorporation in the office of the New York County Clerk on date of September 7th. It is to be capitalized in the sum of $500,000, and the incorporators and trustees are to be found in the persons of Messrs. Eugene Howard, Charles Hull Bottsford, George F. Gadens, and Walter M. Jackson. Bottsford is the jumping-jack who, as the supposed mouthpiece of "Reform-

or Sherwood," made such a ridiculous display of himself during the sessions at the Morton House in this city last spring, when the Senate Committee were "sitting on" the matter of the metropolitan gas supply. Judging from the title of the newly fledged corporation, Botsford seems to believe that the entire territory of the United States is just about large enough to afford proper scope for his talents in the matter of benefiting gas consumers; to ordinary folks it would seem that a much more restricted field might possibly contain him. If any one of our readers would like confirmation of this latter idea we refer them, by permission, to the Honorable Mr. McCann, member of the late State Assembly, from one of the Kings County districts.

Large Talk Concerning Electric Lighting in New England.—E. H. Johnson, President of the Edison Electric Lighting Company of New York city; E. H. Goff, President, and W. J. Jenks, manager of the incandescent department of the Electric Manufacturing Company of New York city; Col. Silas Burney, of the Tremont House, Boston; and Charles B. Whiting, banker, of Worcester, Mass., are the directors of two new companies, organization papers of which were signed and executed in this city on a recent date. The new concerns are to be known as the American-Edison Illuminating Company, of Worcester, Mass., with a capital of $100,000; and one of similar name for Lowell, Mass., with a capital of $50,000. It is said that a contract has been made by the American Company, of this city, to light the city of Portland, Me., under which a large number of the Edison Municipal incandescent lamps are to be employed, and is the initial work under the American-Edison compact made early in the summer. Central lighting stations are to be erected in Worcester and Lowell, and it is asserted that the American Company is preparing and maturing plans for securing street lighting contracts in every New England city. The managers of the corporation are circulating the old-time fables about the great advances made in "their own" arc and incandescent lights, as a result of the alliance secured between the American and Edison Companies, etc. They have gone so far as to claim that, assisted by the "great improvements that have recently been made," they can now successfully compete with gas "at any price at which that commodity can be sold at a profit," and give "at least three times the amount of light, at the same price charged for the gas illuminant." Of course, all these nice-sounding promises are calculated to attract the attention of investors who do not know much about the matter of artificial lighting; and that is the very reason why the electrical promoters are so lavish with their "candle power and cheapness" theories. Once the money is absorbed in the capital stock of the enterprises, the deluded investors find out, through bitter experience, that dividends thereon are "a long time a comin'."

Cheaper Gas for Tiffin, Ohio.—Mr. Jos. Bate, Superintendent of the Tiffin Gas Light Company, writes us that from and after October 1st the price of gas for lighting purposes will be fixed at two dollars per thousand cubic feet. Special rates are made at Tiffin for gas used for fuel and power purposes. This is a reduction of 25 cents per thousand from the former rate. Brother Bate means business.

No Water Gas in that Locality.—The following letter explains itself: "Beaver Falls, Pa., Sept. 8th, 1885.—To the Editor American Gas Light Journal:—The Lowe 'organ,' published at Philadelphia, in its issue for August last, while noting the new discount list of the Beaver Falls Gas Company, says we use the Lowe process. We wish it distinctly understood that we have not made a foot of water gas since the 12th day of last February, and never will while the works are under the present management. Without going into details, our three years' experience with water gas, made in apparatus constructed and erected by Prof. Lowe himself, proved it to cost as much as coal gas, and to be very much less satisfactory to our consumers. We have been furnishing exclusively, since the date in last winter mentioned above, an illuminant which contains 86 per cent. of natural gas. At first we were rather timid about disclosing this fact; but the encouragement received from our largest and most fastidious consumers, in praise of the 'best gas they had ever had,' made us more bold, and we now care not who knows the proportion of natural gas contained in the illuminating agent supplied from our works. We believe we are the first to employ such a percentage of natural gas, and secure the requisite amount of brilliancy, as well as 'stiffness' and power to resist sudden draughts or gusts of wind. This latter quality our product possesses in a degree equal to that of coal gas.

"Yours, etc., J. M. Critchlow, Supt. Beaver Falls Gas Co."

A Great Natural Gas Territory.—Beaver County, Pa., is fast rivaling the famous Murraysville district as the abiding place of the "roarers." A new natural gas company, with a capital of $300,000, and known to corporate fame as the Economy Gas Company, own or rather has leased a plot of about 7,000 acres of territory contiguous to the wells operated by the Bridgewater Gas Company. On a recent date the drills of the new concern penetrated the reservoir or basin, and the managers already rejoice in the possession of the largest well yet struck in that territory. They will pipe, with 8-inch wrought iron mains, 11 miles to Rochester, New Brighton, and Beaver Falls. They have even now secured fuel contracts extending over three years that will net them an annual return of $70,000. The officers of the Economy Company are as follows: H. Hice, President; H. C. Fry, Treasurer; A. F. Allen Brown, Secretary.

Looking for a Contract.—It is said that a proposition was recently made, by a representative of the Evanston (Ills.) Electric Light Company, to the trustees of that city, looking to the lighting of the streets by means of electricity. For the sum of $3,000 (at least so our information goes) the company proposes to place 30 arc lights, and maintain the same, at points where the trustees may direct. In return they want an ordinance giving them the exclusive right to operate and maintain the business of electric lighting, together with the necessary license for erecting poles, etc. Could we call upon Mr. T. A. Cosgrove to forward us particulars regarding what conclusion was arrived at in the matter? We would esteem it a favor.

Boston's Bad Drinking Water.—We learn that the investigation or examination of the water supplied to Boston, Mass., from the Sudbury River and Cochituate has been concluded by the Norfolk and Suffolk Medical Society, and the report shows a serious pollution or contamination of the supply by sewage. It says that the water of Cochituate, which is the chief source of supply to the city, is more dangerous to health than the Mystic water, and the evil grows worse every day. An analysis of the Cochituate fluid shows that, in comparison with water supplied to fourteen other named cities, Boston's drinking water contains the largest proportion of free ammonia and albumenoid ammonia, the products of sewage contamination. The bad features of the case are rendered more striking when it is remembered that 15 years ago the water supplied for potable purposes in Boston was hardly, if at all, surpassed by that afforded or furnished in any other city in the Union.

Personal.—We are informed that Mr. R. P. Spice, the London gas engineer, whose name is known and respected the world over amongst his *confreres*, is at present on a visit to this country. The distinguished gentleman arrived "in the States" about the 1st of September, and the prime object of his appearance here was to pay a visit to "his next of kin," Prof. Robert Spice, of the Polytechnic Institute, Brooklyn, N. Y. We hope that the estimable gentleman will enjoy a right royal time; but it is measurably certain that he will find himself at least partially at home, since it is not his first visit to these shores.

Amusing Himself.—Mr. A. L. Allen, of Poughkeepsie, N. Y., still keeps amusing himself by furnishing the Poughkeepsie *Daily Eagle* with wonderfully elaborate accounts concerning the relative dangers of water and coal gas—or rather between the Allen-Harris style of product and coal gas. Of course, the "Allen" gas takes the premium in every respect—as to freedom from danger, cheapness, brilliancy, and so on. One paragraph in Mr. Allen's latest communication we will here put on record. It is thusly: "The Citizens Gas Company, of Poughkeepsie, working for ten years under this process, has fully demonstrated the truth of the above statement * * * by purifying an average of 113,000 cubic feet per bushel of ordinary slacked lime. No other process in the world has ever approached such results. The highest average obtained by the largest and best coal companies has fallen short of 5,000 cubic feet." Oh! Mr. Allen! Evidently, from the foregoing, the Cooper Coal Liming Process would have but little chance of obtaining a foothold at the Poughkeepsie Citizens' works.

A Practical Example as to Which Sort is the More Dangerous.—Now, while Mr. Allen is engaged on the work of amusing others (if not himself) with his comparisons as to the relative dangers of water and coal gas, speaking in regard to their effect on the human system, we are unfortunately required to give frequent examples of a practical nature in regard thereto. The latest instance of the kind is in the following account which is taken from the columns of a Rochester, N. Y., daily paper, date of August 30th, 1885. "Among those who registered at the Congress Hall hotel on Friday evening, was Geo. W. Bell, a commercial traveler from the town of Phelps, in this State. Bell retired just before midnight, occupying one of the rooms on the third floor. Yesterday forenoon (Aug. 29th) a chambermaid informed Frederick Rafe, the clerk, that there was something wrong in Mr. Bell's room. The door was forced open, and Bell was found lying on the bed unconscious. The gas burner was partly open, and the room was filled with gas. Dr. Davison was summoned, and later on, Dr. Hovey, but all efforts to restore Bell to consciousness were in vain, and the unfortunate man expired shortly before one o'clock that afternoon. Coroner Sharpe was called, but after learning the facts in the case, deemed an inquest unnecessary. A sister of the deceased arrived in the evening, in response to a telegram informing her of the sad occurrence, and took charge of the remains." The death of Mr.

Bell makes the fourth case of fatal gas suffocation in Rochester since the introduction of water gas there. On the contrary, the old Rochester coal gas light company has been in operation since 1849, and that corporation cannot be charged with contributing a single name to the ever-growing list of cases credited to "suffocated by gas."

REPLACING OR DISPLACING THE ELECTRIC LAMPS.—The Siemens Regenerative Gas Lamp Company, of Philadelphia, Pa., keeps on the "even tenor of its way" in the matter of "rooting out" the arc lights that hitherto held lighting sway in many of the squares of the City of Brotherly Love. The latest case of "rooting out" is that done at Franklin Square, where 17 electric lights have been dispensed with, and in their stead were placed the Siemens high-power burners. The average citizen is delighted with the effects in lighting developed by the substitution, and it pleases us to add that the authorities have authorized the Siemens Company managers to place their lanterns on three additional squares. Keep it up, Brother Stein. But that advice is hardly necessary, for "keep it up" you certainly will.

WHAT IS THE CITY COUNCIL AFTER?—Certain members of the Columbus (Ohio) City Council are engaged in making a most absurd rumpus over the way in which the "gas consumers are being swindled by the Columbus Gas Company." Some of the more asinine members of that "highly honorable" conclave have had the unblushing effrontery to assert that, while the company had been reducing the price of gas, the bills to consumers for same had not materially diminished. They claimed that tests which had been made proved that the pressure maintained had been so greatly increased that fully 40 per cent. of gas "had been forced through the jets and not consumed;" one erudite councilman explaining that "this counted all the same in the reading of meters and keeping up the bills." By the way, would it not be well to call "our own Bottsford's" attention to this Columbus councilman, since it would appear likely that he (the councilman) might make a valuable addition to that "Consumers' Benefit" organization alluded to in another column. It is not to be supposed that Emerson McMillin is the sort of man to stand idly twiddling his thumbs while listening to the charges of extortion and fraud made against his company by the blowhards of the Columbus Council. On the contrary, "Mac" was up and doing; and the answer made by him, through the public prints of his city, in regard to the charges formulated, is complete and convincing. We regret that our copy of same reached us too late for publication in this issue, but in our next we will reproduce it in detail. By that time we will also have received the official results of the pressure tests which were to have been made this week, and which undoubtedly have shown up in its true light either the ignorance or willful mendacity of the "city fathers." It might be barely possible that the Columbus Councilmen are striving to stir up a sentiment unfavorable to the gas company, in order that, under cover of the same, they may pattern after the model set them by their prototypes in Chicago, Ills. In plain English, that they may set afloat a blackmailing opposition scheme. But, on the other hand, it would not appear so likely, either, that such unfavorable sentiment toward the gas company could be excited to any considerable extent, since Mr. McMillin's treatment of his patrons has been of such a nature as to secure to him and his company their hearty goodwill and co-operation. His course in the past will be of great service to him now.

TRYING TO CHEAPEN THE RATES.—Mr. J. L. Stamford, Manager of the Olympia (Washington Territory) Gas Light Company, writes us that on August 15th last the following notice was issued to the citizens of that town: "We now have 40 consumers on our books, and, with a view of increasing its sendout, the Olympia Gas Company offers the following proposition: Upon all gas bills paid by the fifth day of each month, when the number of consumers have been increased to 50, a discount of 50 cents per thousand cubic feet will be allowed, or a rate of $3.50 per thousand be thereby established. When the list has been increased to 100 consumers, a further discount of 50 cents per thousand will become operative. As the number of our patrons increases over the 100 limit other reductions will be made." A rather novel plan seems that instituted by Mr. Stamford, and it looks to us as though Mr. S. has managed to secure the services of 40 active canvassers. Taken as a whole, it is far from being a poor line of policy, and we make little doubt but that the "hundred notch" will speedily be reached. Gas was turned on at Olympia for the first time on the evening of March 27th, 1885; and while it is the capital seat of the Territory, it contains a population of but about 1,400 inhabitants. Now, it goes without saying that the people who invested money in the Olympia gas plant must have had great faith in the future of their town, and, if it were for no other reason, we hope their enterprise may prove successful on account of the "pluck" thus shown.

THE PLUMBERS MAY STRIKE.—It is rumored that the journeymen plumbers of New York city are about to come in conflict with their employers, the question of wages being at the bottom of the movement. Their demand is that the daily rate of pay be advanced from $3 to $3.50; but the "bosses" cannot be prevailed upon to accept the proposed new scale. A "lock-out," it may be predicted, is tolerably certain to occur.

NATURAL GAS EXPLOSION.—A severe explosion occurred at Pittsburgh, Pa., on the morning of August 31, in the oven room of S. S. Marvin & Co.'s steam bakery. Five persons were severely injured thereby. The firm had recently introduced natural gas as the agent for heating the ovens, and the explosion resulted through the carelessness of one of the company's employees.

SPONTANEOUS IGNITION.—Some peculiar instances of spontaneous "ignition" of various substances, with attended loss of property, would appear, says an exchange, to have been due to simple ignorance of the relations of animal, vegetable, and mineral oils to combustion. Prof. Attfield points out that the two former are much safer than the latter, since they do not ignite at low temperatures nor give off vapor which, when mixed with a certain portion of air, explodes in contact with flame; on the other hand, in their liability to spontaneous ignition, when freely exposed to the air under certain conditions, they possess a dangerous property from which the mineral oils are free. Then, too, the animal and vegetable oils differ considerably among themselves in the rate at which they cause the generation of heat on being exposed to air, upon the surface of fabrics, shavings, or other materials; though all are more or less liable to this result when spread out in thin films, or in any other state of minute division. What are known as drying oils are particularly susceptible to such atmospheric influences, the drying itself consisting in the conversion of the oil into a kind of rosin by the action of the air.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Sidewalk Stopcocks.

OFFICE OF TIFFIN GAS COMPANY,
TIFFIN, OHIO, Sept. 4, 1885.

To the Editor AMERICAN GAS LIGHT JOURNAL:

I am much interested in the question, discussed at the late Western Association meeting, regarding stopcocks at sidewalks to consumers' services.

Some 15 or 16 years ago, when my brother, T. A. Bate, was in charge of the New Albany (Ind.) gas works, I was employed by the same company, and I well remember that he assigned me the duty of "going all over town to dig up and repair the stops at curbstones." In no instance did I find (except in the case of those recently placed) a stopcock that would turn without expenditure of much force upon it, and not a few of them "lost their heads" in the operation.

I have been manager of the Tiffin works for 13 years, and have never put in a stopcock at curb. When the larger services (from one to two inch) are run, I place a main stop at area or street wall. Have "gone through *some* fires," and always shut off the gas. Have a bag, loaded with the necessary tools, at both my house and the office. Always "run to fires;" and my assistant does the same. Of course, it is understood that we are speaking of small places.

In large cities I presume a straightway valve would answer for large services, and be easily turned; but still these must naturally require some attention. Stopcock boxes gather dirt, and are great retainers of frosty accumulation. We have a few old services equipped with stops; but on all new ones they are omitted. If, for any reason, a consumer has his supply cut off, we remove the inlet connection at once and cap the service—indeed we would be most happy to discover *anyone* outside of the gas company who would make such removal. There are laws operative in the State of Ohio that recognize even the rights of gas companies.

Yours,
JOS. BATE, Sec'y. and Supt.

Recent Patents.

[The following list of patents, relating to improvements in gas apparatus, etc., issued by the United States Patent Office on the dates specified, is specially reported for the JOURNAL by FRANKLIN J. HOUGH, Solicitor of American and Foreign Patents, 925 F street, N. W., Washington, D. C.]

ISSUE OF SEPT. 1, 1885.

325,448.—Gas and air, apparatus for mixing. J. R. Scrimshaw, Brooklyn, N.Y.
325,590.—Gas and oil pipes, automatic stop valve for. W. S. Cosgrove and F. F. Jennings, Jersey City, N. J.
325,378.—Gas engine. C. W. Baldwin, Yonkers, N. Y.
325,509.—Gas pressure regulator. E. Derval, Paris, France.
325,510.—Ditto. R. B. Dick, Philadelphia, Pa.
325,459.—Gases and fluids, device for regulating flow of. G. Taylor, Jersey City, N. J.

ISSUE OF SEPT. 8, 1885.

325,766.—Gas, apparatus for generating illuminating. L. M. Potter and R. Boeklen, Jersey City, N. J.
325,747.—Gas burner. I. Kendrick, Phila, Pa.
325,928.—Gas burner, automatic safety. Haines & Strong, Flushing, L. I.
325,786.—Gas lighter. J. A. Cabot, New York City.
325,589.—Gas service valve. H. A. Stearns, Lincoln, R. I.

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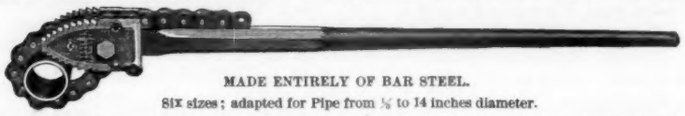
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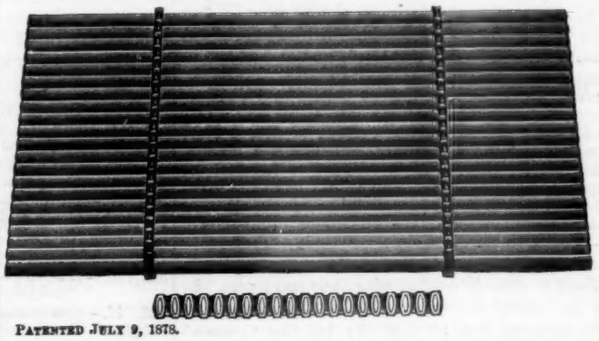
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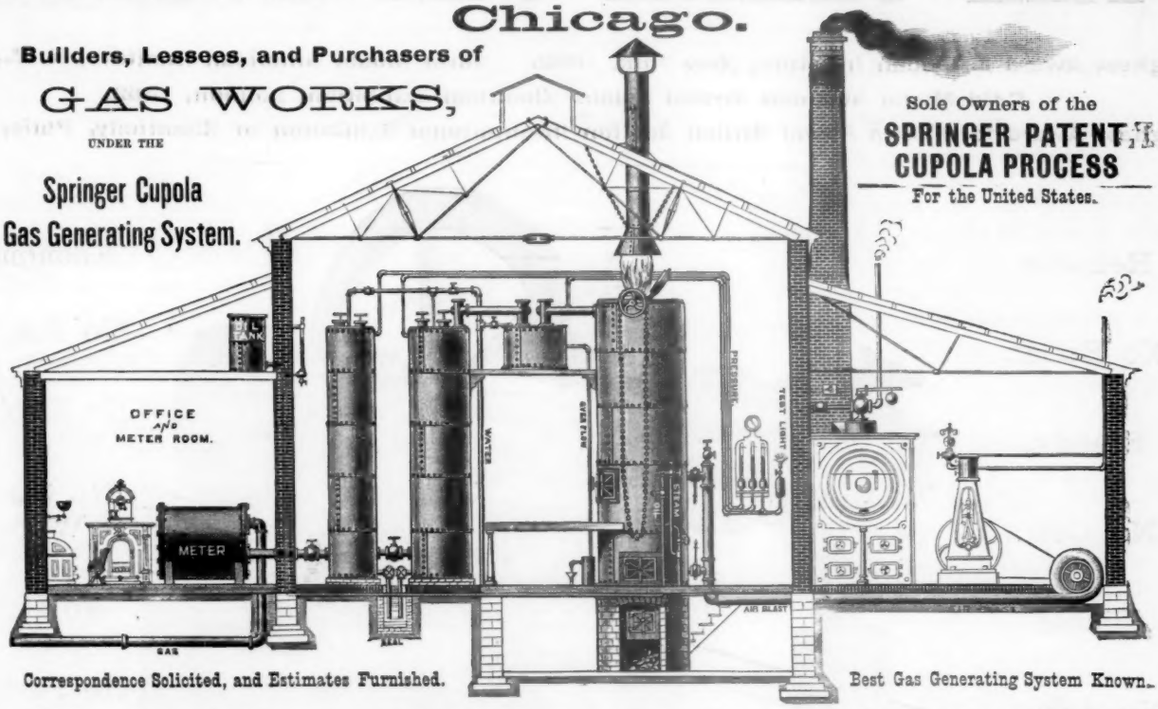

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A new and important Pipe Fitting for Steam, Water, or Gas. Combining a variable angle or elbow and a union. Saves pipe, saves time, decreases friction and radiation, gives a union joint at every angle, and **can be set at any angle** at which it is desired to run the pipe.

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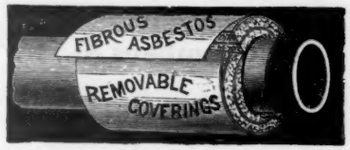

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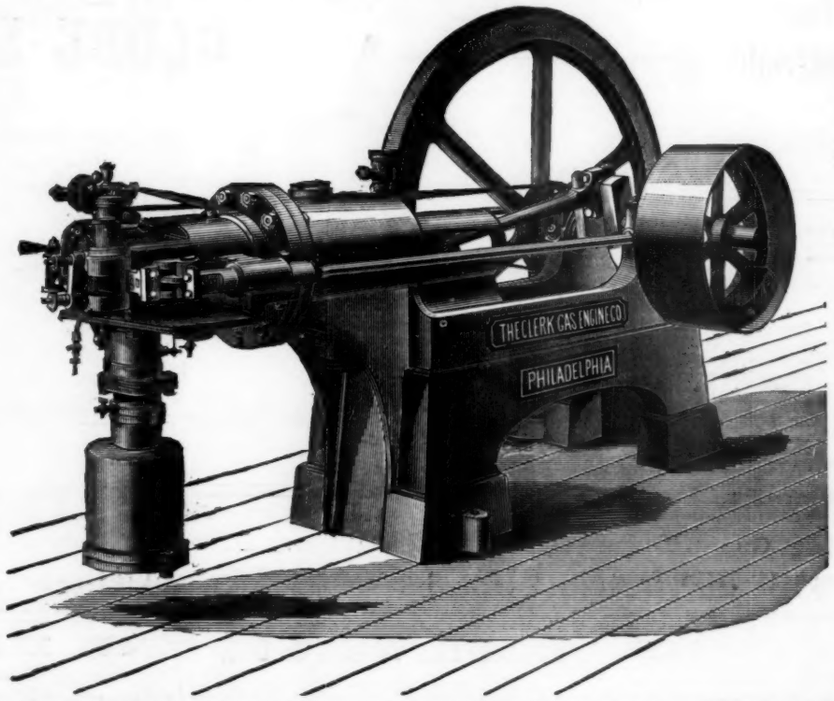

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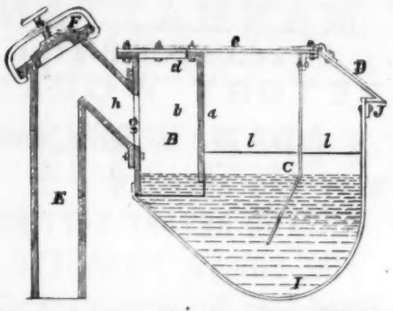

Boardman Hydraulic Main,

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For description, see AM. GAS LIGHT JOURNAL of Feb. 2, 1884.
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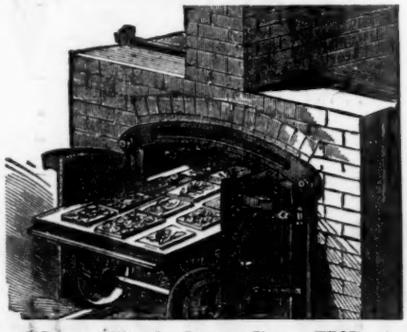

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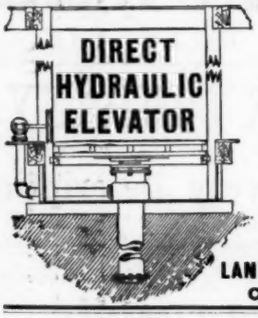

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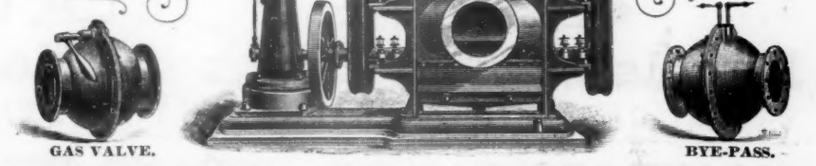

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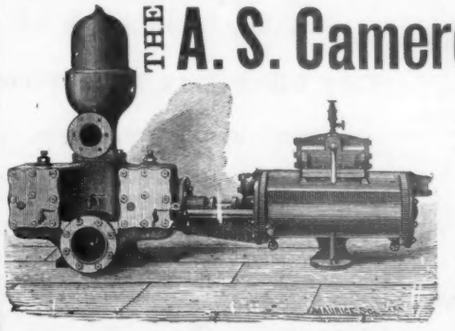

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20	1.00 in.	7.75	33.00
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60	.....	.....	.....

BURNER, by use of which Gasoline Stove is changed to Gas Stove.

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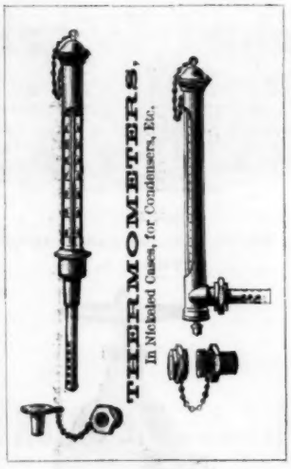

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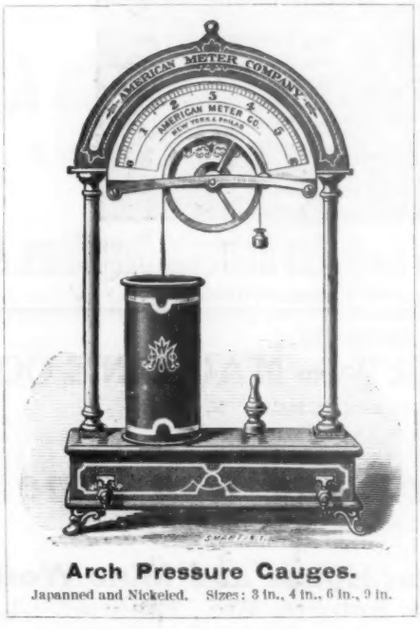

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Pressure Gauges.

4 inch,	Nickeled.
6 inch,	"
8 inch,	"
10 inch,	"
12 inch,	"
14 inch,	"
16 inch,	"
18 inch,	"
20 inch,	"
24 inch,	"

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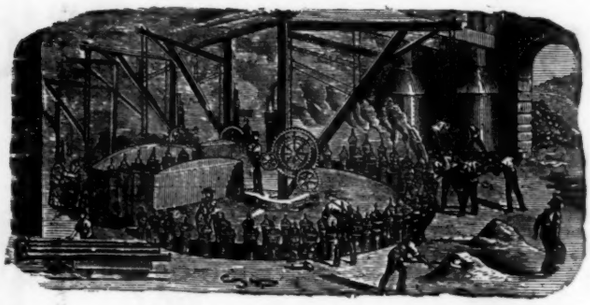

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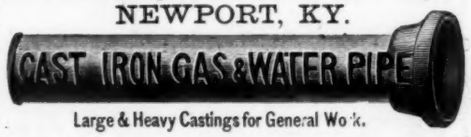

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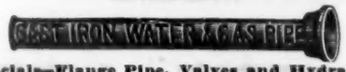

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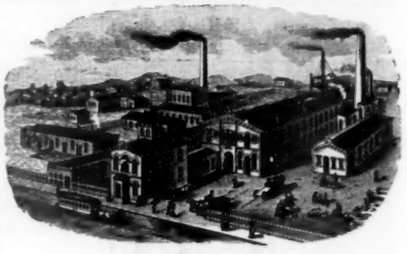

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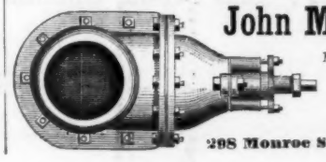

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Siemens's Regenerative Gas Burners,

For Lighting and Ventilating.

THE CHEAPEST, PUREST, AND MOST BRILLIANT OF ALL GAS LIGHTS.

Superior to the Electric Light in Economy, Beauty, & Steadiness.

SPECIALLY ADAPTED FOR LIGHTING HALLS, FACTORIES, OPEN SPACES, ETC.

Numerous Tests made by various Gas Companies in the United States show an Efficiency of Ten Candle Power per Cubic Foot of Gas.

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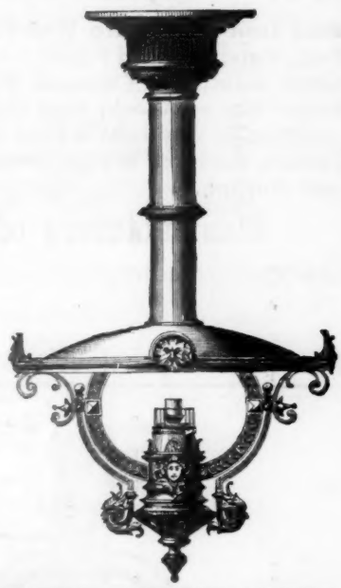

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THE "STANDARD" WASHER-SCRUBBER,

KIRKHAM, HULETT & CHANDLER'S PATENT.

Total Capacity per 24 Hours of "Standard" Washers Ordered During the Following Years.

1877	4,000,000 cubic feet.
1878	4,750,000 "
1879	24,545,000 "
1880	42,967,500 "
1881	36,462,500 "
1882	39,300,000 "
1883	57,735,000 "
1884	26,177,500 "
Total	235,937,500 cubic feet.

Total Number and Capacity per 24 Hours of "Standard" Washers Erected and in Course of Erection in the Several Countries

	Number.	Cubic Feet per Day.
Great Britain	151	157,070,000
Western Hemisphere	38	39,337,500
Australia	18	12,150,000
New Zealand	2	650,000
France	6	4,550,000
Belgium	8	5,490,000
Germany	16	8,200,000
Holland	4	4,160,000
Denmark	1	150,000
Russia	2	3,500,000
Spain	1	350,000
India	1	400,000
Total	248	235,937,500

THE CONTINUED POPULARITY
Of these Machines

Will be recognized from the following extracts from letters from representatives of some of the companies having them in use:

PROVIDENCE GAS COMPANY.
PROVIDENCE, R. I., Nov. 24, 1884.

GEO. SHEPARD PAGE, Esq., New York:

Dear Sir—We are now using less than a gallon of water per thousand in the "Standard," and the gas at the outlet will not color turmeric paper.

Yours etc.,
A. B. SLATER, Treasurer.

PORTLAND GAS COMPANY.
PORTLAND, ORE., Nov. 29, 1884.

GEO. SHEPERD PAGE, New York:

Dear Sir—Our Scrubber appears to run to our entire satisfaction, and we are pleased to say that it takes out all the ammonia from the gas. This is *very* satisfactory to us, as we were ruining our meters at a fearful rate heretofore. The amount of water used is very inconsiderable as compared with our old process. The machine runs very smooth and still. Very respectfully,

H. C. LEONARD, Secretary.

"Standard" Washers Ordered Recently.

	Cu. Ft. per Day
Anneberg Gas Co	200,000
Bombay Gas Co	400,000
Brussels Co	1,250,000
CHICAGO, two, 1,000,000 each	2,000,000
Chemnitz Gas Co	1,000,000
CITIZENS GAS CO., BUFFALO	750,000
Coke Works in Zabre, Ober-Schlesien	1,500,00
Cokerei der Friedenshutte, Upper Silesia	700,000
Dumfries Corporation	250,000
Dunedin Gas Co., New Zealand	400,000
GEORGETOWN, D. C	250,000
King's Lynn Gas Co	300,000
Leiden, Holland	600,000
Lincoln Gas Co	400,000
Liverpool Gas Co	2,000,000
" "	3,000,000
LOUISVILLE GAS CO	1,500,000
Numea Gas Co	100,000
PITTSBURGH GAS CO	1,500,000
PAWTUCKET, R. I	500,000
PORTLAND GAS CO., Oregon	562,500
SAN FRANCISCO GAS CO	4,000,000
Sheepbridge	40,000
ST. LOUIS GAS CO	2,000,000
Sydney Gas Co	2,500,000
WASHINGTON, D. C. GAS CO	2,000,000
Whitchurch Gas Co	175,000
Total	29,677,500

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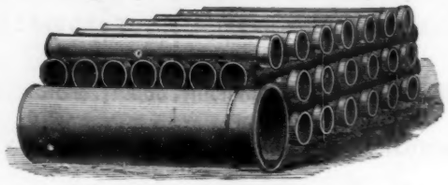

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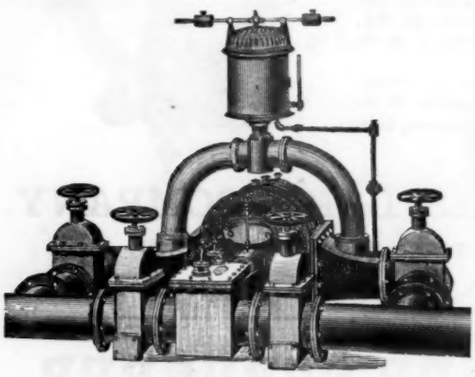

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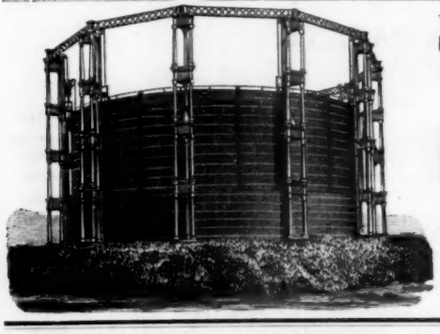

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Canton, "	"	60,000	"
Akron, "	"	80,000	"
Xenia, "	"	10,000	"
Adrian, Mich	"	65,000	"
Ypsilanti, Mich	"	25,000	"
Muskegon, "	"	70,000	"
South Bend, Ind	"	70,000	"
Anderson, "	"	20,000	"
Plainfield, "	"	10,000	"
Springfield, Illinois	"	100,000	"
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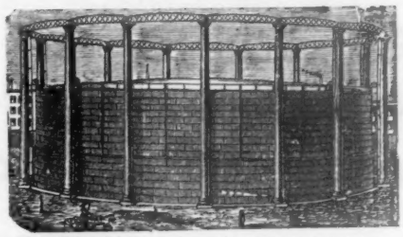

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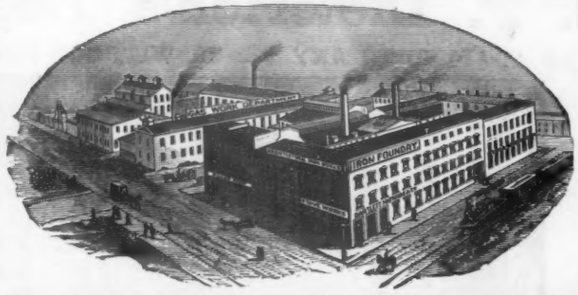

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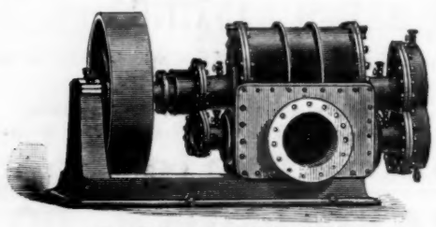

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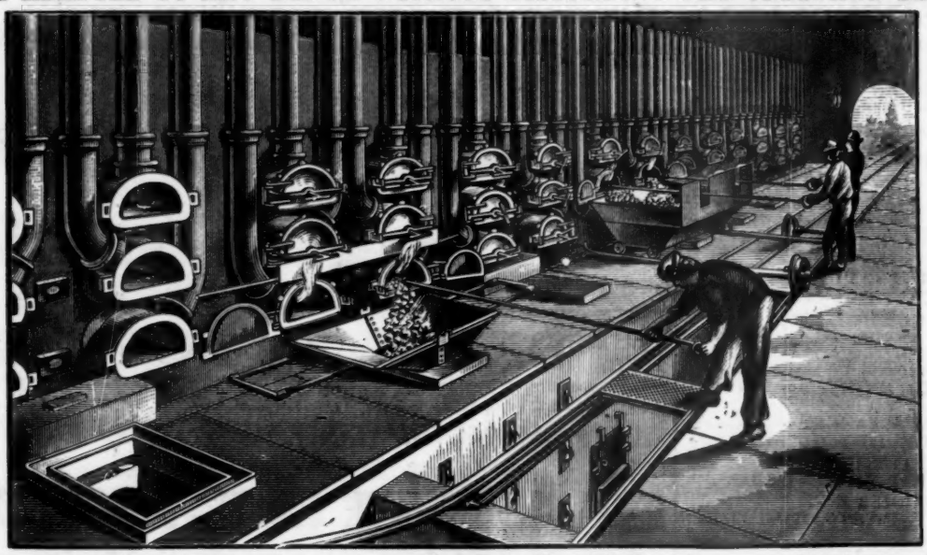

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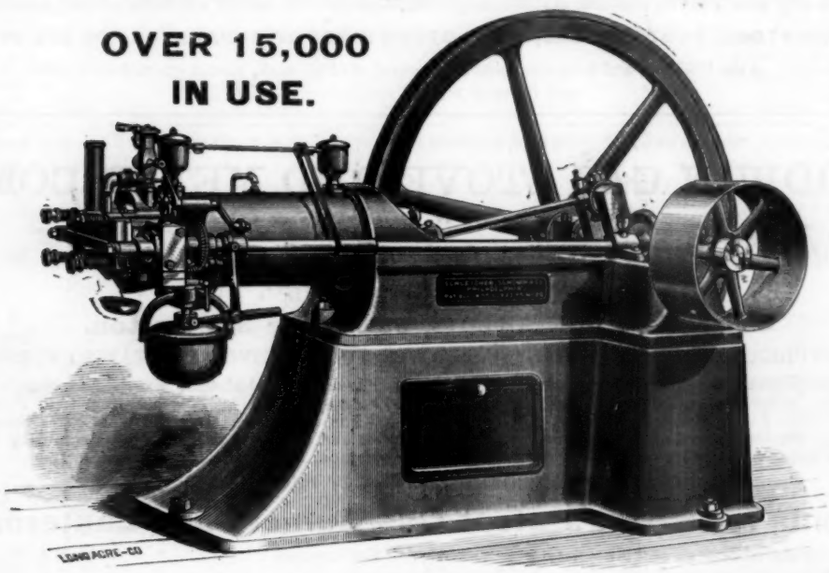

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